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Head Office—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office—41, Queen's Gate, London, S.W.7.

IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW

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APPLIED ENTOMOLOGY.

SERIES A.

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KOCH (K.). **Aphid Transmission of Potato Yellow Dwarf.**—*Phytopathology* **24** no. 10 pp. 1126–1127. Lancaster, Pa, October 1934.

The high percentage of yellow dwarf disease of potato in many commercial seed stocks in the United States suggested insect transmission. In laboratory experiments with three varieties of potato, 60·5 per cent. infection was obtained with *Myzus persicae*, Sulz., but results with *Macrosiphum solanifolii*, Ashm., and *Thrips tabaci*, Lind., were mostly negative.

GARDNER (M. W.) & WHIPPLE (O. C.). **Spotted Wilt of Tomatoes and its Transmission by Thrips. (Abstract.)**—*Phytopathology* **24** no. 10 p. 1136. Lancaster, Pa, October 1934.

Successful transmission by thrips of spotted wilt [*cf. R.A.E.*, A **18** 665 ; etc.], a serious disease of tomato in the United States especially in the cooler coastal regions, and also of peppers [*Capsicum*], head lettuce, and nasturtium [*Tropaeolum*] and other flowering plants, was obtained between tomato, *Capsicum* and *Datura*, from tomato to *Petunia*, from *Datura* to aster, and from *Cineraria* and *Calceolaria* to tomato.

LEACH (J. G.), ORR (L. W.) & CHRISTENSEN (C.). **The Interrelationships of Bark Beetles and Blue-staining Fungi in felled Norway Pine Timber.**—*J. agric. Res.* **49** no. 4 pp. 315–341, 13 figs., 20 refs. Washington, D.C., 15th August 1934. [Recd. November 1934.]

Results are given of investigations begun in 1931 on *Ips pini*, Say, and *I. grandicollis*, Eichh., and the fungi associated with them in Norway pine (*Pinus resinosa*). They are part of a project to study in detail the interrelations of certain insects and fungi attacking felled timber. There are two generations in Minnesota, one emerging in midsummer, the other in autumn or early spring.

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The following is largely taken from the authors' summary: According to the evidence from experiments in which some logs were used as a control, and others were so treated as to eliminate infection by wind-blown spores, the bark-beetles introduce blue-staining fungi into the logs, and these fungi are rarely, if ever, introduced in any other way. Two fungi, *Ceratostomella ips* [*R.A.E.*, A **20** 172], the more prevalent, and *Tuberculariella ips*, sp. n., were associated with each of the beetles. Certain cultures of *Graphium* isolated from stained wood and from beetles were identical with *C. ips*; although they did not produce perithecia, some cultures derived from single ascopores of *C. ips* also failed to do so. Characteristic yeasts were constantly associated with the beetles. The fungi are introduced by both sexes and quickly become established, the yeast more extensively at first in the inner bark and the blue-stain fungi in the sapwood. Because of differences in the tunnel patterns, the fungi are distributed more widely in a log infected by *I. pini* than in one infected by *I. grandicollis*. Mites are carried into the tunnels on the thorax and in the concave wing declivities of the beetles. These mites drop off in the tunnels and move about, probably aiding in the dispersal of fungus spores throughout the burrows, as yeast cells and fungus spores were found adhering to their bodies. The fungi reproduce profusely during the pupation of the beetles, and when the adults emerge and feed extensively under the bark, they collect the sticky spores from the fruiting bodies, which project from the walls of the burrows. Sexual and asexual spores, yeast cells and even parts of the perithecia were found in the intestine of the beetles; they showed no signs of injury and germinated after passing from the digestive tract. No fungi were found in the pupae. Histological studies of the adults revealed no anatomical modifications for the transmission of the fungi to the offspring, and the eggs were internally sterile, although yeasts and fungus mycelium were abundant in the sawdust plugs covering the eggs in the niches. It is presumed that a symbiotic association exists between the beetles and the fungi, and it cannot yet be concluded that the fungi are not necessary to the development of the beetle.

RICHARDSON (H. H.). **Studies of Derris, Nicotine, Paris Green, and other Poisons in Combination with Molasses in the Control of the Gladiolus Thrips.**—*J. agric. Res.* **49** no. 4 pp. 359–373, 4 figs., 11 refs. Washington, D.C., 15th August 1934. [Recd. November 1934.]

Experiments were carried out in the United States in 1932–33, in the laboratory and in the greenhouse, to study the action of the residues of a spray containing Paris green and brown sugar [*R.A.E.*, A **21** 466] and other sprays mainly on *Taeniothrips gladioli*, Moult. & Stnw. The concentrations of the various materials in the spray water is shown as parts by weight for solids, and parts by volume for liquids.

The following is largely taken from the author's summary: Of 8 nicotine sprays tested, the deposit left by one of nicotine sulphate and molasses (1 : 20 : 400) was the most efficient, killing 94–98 per cent. of the larvae emerging on sprayed gladiolus foliage within 6–8 days of the application. It was, however, only toxic to older larvae and adults for a short time after spraying, and was not promising in the greenhouse. Paris green (1 : 800 or weaker) was much more toxic when used with 3 per cent. molasses, either blackstrap or higher grades, than with

brown-sugar solution; chemical analyses show that it was more soluble in the former than in the latter, and least soluble in tap water. The deposits from both the molasses and the brown-sugar sprays retained their toxicity for some time, even after exposure to rain, and both were effective in the greenhouse, though some foliage injury resulted, especially on plants heavily infested by the thrips. Molasses did not act as a bait. Of three sprays prepared with an acetone extract of derris containing 5·7 gm. rotenone and 18·1 gm. total extractives per 100 cc., one (1 : 250) used with 5 per cent. molasses gave the best results, leaving a highly toxic deposit, and being effective in the greenhouse. The residue of derris extract (1 : 250) alone or in combination with soap or sulphonated castor oil was toxic for a short time, but lost toxicity faster than the derris-molasses residue when exposed to direct or glass-filtered sunlight. The latter residue, however, was easily washed off by rain, and in the field was attacked by fungus (particularly *Cladosporium* sp.). It gave commercial control of *Thrips nigropilosus*, Uzel, on *Cineraria* in the greenhouse, but was not effective against *T. tabaci*, Lind., on onion. For the control of the latter, derris extract with sulphonated castor oil (1 : 400) was more efficient than nicotine sulphate and soap both in the greenhouse and in small field tests; it also showed promising results against *Tetranychus telarius*, L. (*bimaculatus*, Harvey) on roses and other plants. Hellebore powder at several concentrations with 5 per cent. molasses left a toxic and fairly stable deposit, which showed considerable efficiency against *T. gladioli*, and when sulphonated castor oil (1 : 400) was added to a spray of hellebore and molasses (1 : 20 : 400) as a wetting agent, the mixture was effective against *T. tabaci* on onion in the field and in the greenhouse. Pyrethrum extract spray (1 : 10,000 pyrethrin I) with 3 per cent. molasses or waste sulphite liquor (1 : 133) left a deposit that was slightly toxic for a short time. Tartar emetic (1 : 400 with 3 per cent. molasses) and borax (1 : 200 with 5 per cent. molasses) were very toxic to adult thrips, but the latter spray injured the foliage. Calcium arsenate (1 : 533 and 1 : 266), lead arsenate (1 : 200) and copper sulphate, all used in combination with molasses, were moderately toxic but acted much more slowly than the Paris green residue.

HERR (E. A.). **The Gladiolus Thrips** *Taeniothrips gladioli* **M. & S.**—*Bull. Ohio agric. Exp. Sta.* no. 537, 64 pp., 12 figs., 26 refs. Wooster, Ohio, August 1934. [Recd November 1934.]

A detailed account is given of the bionomics and control of *Taeniothrips gladioli*, Moult. & Stnw., which was first recorded in Ohio on *Gladiolus* in 1929 [*R.A.E.*, A **19** 310]. Its history, distribution and economic importance are discussed, and all stages are described. A list is given of other species of thrips that have been found on *Gladiolus* [**21** 464]. Usually there are more females than males, but it is thought that polygamy limits the numbers of unpaired females. The progeny of 20 unpaired females were all males, but unfertilised females mated with their offspring produced both males and females, so that one could initiate an infestation. Data obtained in storage on the life-history in relation to temperature show that it is impossible to obtain a complete generation at 50°F., although eggs hatched in 22·6 days, and that development was generally accelerated by increase of temperature [*cf.* **21** 465; **22** 536]. On plants under field conditions at an average temperature of 73°F., the total period from egg

to adult lasted 9–17 days with an average of 13·6. From 10th June to 15th October 1932 nine generations were reared in the insectary, but since *Gladiolus* is often planted early in April there may normally be more generations in a growing season. The optimum conditions are heat and dryness ; heavy rain may reduce the thrips population by half, more adults than larvae being destroyed. Hibernation experiments showed that no thrips survived in the field during the winter of 1932–33. Adults and nymphs are sluggish, but migration occurs in heavy infestations. The thrips has been found on many other flowers and plants both in the field and in the greenhouse. The adults and larvae attack the leaves and the flower spikes, the surface cells are punctured and the cell sap and chlorophyll withdrawn, leaving colourless patches in light infestations and resulting in deformed or undeveloped flowers in heavy ones. Varieties of *Gladiolus* that bloom late were generally more susceptible than others. Infested corms in storage soon became sticky from the exudation of injured cells and their market value was lowered, but both the juices and the epidermal cells harden quickly. The root-forming cells were sometimes injured, retarding or impairing the subsequent growth, and when developing buds were attacked the corms frequently failed to germinate. Stored cormels are immune [**20** 699].

The following are the recommendations for control : When corms are harvested the tops should be removed except for a short tuft ; the pruning should be done away from the container. They should at once be removed from the vicinity of the plantation and if possible cured before storage. The corms may be fumigated in the autumn to avoid any possibility of infestation, especially in cases where a temperature as low as 40–50°F. cannot be maintained in the store. Three fumigants are available [*cf.* **21** 465], of which naphthalene flakes (1 oz. to 100 corms) are cheap, safe to use, and effective against all stages in one application. The fumigation must continue for at least three weeks, and no injury will result if the prescribed quantity is left on the corms until it has all evaporated, unless the shoots and roots have commenced to develop. An outdoor pit is described that is satisfactory for storing small numbers of corms. All refuse from storage should be destroyed. On small plots a driving spray from a garden hose is fairly effective. Of many sprays tested, one containing Paris green and brown sugar [**22** 536] was the most successful.

TRAVIS (B. V.). **Notes on the Habits of June Beetles in Iowa (Phyllophaga-Coleoptera).**—*Iowa St. Coll. J. Sci.* **7** no. 4 pp. 397–406, 1 fig., 8 refs. Ames, Iowa, 1933. [Recd. November 1934.]

Observations were made during the spring and summer of 1932 in Iowa on flights, pairing, and light-trap collections of 21 species of *Lachnosterna* (*Phyllophaga*). The evening flights began between 7.55 and 8.21 p.m. and the morning ones between 3.25 and 4.15 a.m. ; the time of starting varied with the clearness of the sky. Flight was either direct from leaves and twigs, or, particularly in cool cloudy weather, the beetles dropped to the ground, some taking wing during their fall. On reaching the ground they burrowed into the soil. The order of commencement of flight was constant in the different species. When *L.* (*P.*) *hirticula*, Knoch, and *L.* (*P.*) *horni*, Smith, were kept in cages, the evening emergence extended over about 50 minutes and the peak was reached 15–20 minutes after the first adult left its hiding place. Pairing

usually occurred on food-plants. Two light-traps caught only 1,266 beetles during the entire summer, so that they were less effective than they have been found to be elsewhere [*R.A.E.*, A **4** 283]. Of the beetles caught 62·3 per cent. were males. Of the species collected during 1932, *L.* (*P.*) *congrua*, Lec., was recorded for the first time in the State.

CRAIG (L. C.) & RICHARDSON (C. H.). **Insecticidal Action in the Nitrogen Heterocyclic Compounds.**—*Iowa St. Coll. J. Sci.* **7** no. 4 pp. 477–485, 18 refs. Ames, Iowa, 1933. [Recd. November 1934.]

The following is based on the authors' summary: The results are given of studies of the relative toxicity (expressed as the concentration that killed 50 per cent. in 24 hours) of 11 α-substituted N-methylpyrrolidine compounds to *Aphis rumicis*, L. The negativity of the substituted radicals as measured by the dissociation constants varied within wide limits (10^{-4} and 10^{-7}). The toxicity of most of the compounds to goldfish, tadpoles and lupin seedlings are included for comparison. The compounds were made up with 0·25 per cent. sodium oleate and applied as a fine spray to the wingless adults. There was a correlation between the relative toxicity and the basicity (dissociation constants) of the compounds, the former decreasing as the latter increased. The causes of this are discussed. *l*-Nicotine was considerably more toxic to Aphids than the optically inactive mixture (*dl*-nicotine). The recent literature [*cf. R.A.E.*, A **19** 100; **21** 342] on the toxic action of anabasine (*dl*-(β-pyridyl)-N-piperidine) and its N-methyl derivative is discussed in relation to nicotine.

TRAVIS (B. V.) & DECKER (G. C.). **A Study on the Use of Arsenical Dust for the Control of June Beetles.**—*Iowa St. Coll. J. Sci* **7** no. 4 pp. 493–498, 1 fig. Ames, Iowa, 1933. [Recd. November 1934.]

As the result of some success obtained by the application by aeroplane of a dust of calcium arsenate and bentonite (4 : 6) against June beetles [*Lachnosterna*] on oak trees in Iowa in June 1932, laboratory experiments were carried out to test the value of this dust against them. The methods used are described.

The following is substantially the authors' summary: The beetles were killed by eating the poisoned leaves but not by ingesting free dust from their appendages. Males appeared to be more susceptible to arsenical poisoning than females. Temperatures too low to induce normal feeding reduced the effectiveness of the poison. Moderate and heavy applications of the dust killed 65–100 per cent. of the beetles in less than 72 hours. There was a direct correlation between the rate of application and the time required to kill the beetles. Poisoned leaves were consumed sparingly, whereas undusted foliage was readily eaten.

ANDRE (F.) & TATE (H. D.). **Observations on the Winter Survival of Plant Lice in Iowa (Homoptera-Aphiidae).**—*Iowa St. Coll. J. Sci.* **7** no. 4 pp. 499–503, 1 fig., 5 refs. Ames, Iowa, 1933. [Recd. November 1934.]

Hibernation studies indicated that members of several genera of Aphids, and particularly *Rhopalosiphum prunifoliae*, Fitch, overwinter

in Iowa as nymphs and apterous and alate viviparous adults, as well as in the egg stage. The adults of virus-carrying species may thus act as reservoirs for the plant diseases over the winter. A list is given of the Aphids obtained during the winter of 1932–33 from samples of moss or bluegrass sod in various localities. The mean temperature varied from 20 to 50°F., and the monthly rainfall from ½ to 2 ins. All the Aphids were collected from exposed areas with no protective covering of snow. As many as 7 were found to 4 sq. ft. of moss and often 3–5 to about 3 sq. feet of bluegrass sod The survival of summer forms is greatly influenced by the condition of the surrounding vegetation in the autumn and winter. On 5th April when the outdoor temperature was about freezing point, several adults of *R. prunifoliae* were collected from bluegrass sod and placed on growing plants in the greenhouse ; within a few hours, parthenogenetic reproduction began and normal activity continued.

PEMBERTON (C. E.). **Local Investigations on the introduced tropical American Toad** *Bufo marinus.—Hawaii. Plant. Rec.* **38** no. 3 pp. 186–192, 2 figs. Honolulu, 1934.

Notes are given on the breeding, distribution and feeding habits of *Bufo marinus* in Hawaii, where it has increased rapidly since its introduction in 1932 [*R.A.E.*, A **21** 235] and has been observed feeding on all available insects. The toads commonly return to places where insects are abundant. In one case several congregated in the evening outside two beehives and ate the bees crawling about the entrances. It is suggested that hives should be raised two or more feet above the ground or that apiaries should be surrounded by low wire fencing.

MENOR Y ORTEGA (J. G.). **Informe del entomólogo-patólogo.** [Report of the Entomologist-Pathologist.]—*Mem. Sec. Agric. Com. Repub. Dominicana 1932* pp. 117–133. Santo Domingo, 1934.

Pests observed in Santo Domingo in 1932 included : the mite, *Tarsonemus oryzae*, Can., on rice, causing the plants to wither completely ; the Bostrychids, *Dinoderus minutus*, F., in stored rice, and *Apate francisca*, F., boring in coffee shoots ; the Melolonthid, *Lachnosterna neglecta*, Blanch., on the roots of coffee ; the Cassidid, *Chirida* (*Coptocycla*) *guttata*, Ol., and the weevil, *Euscepes batatae*, Waterh., on sweet potato ; *Bruchus chinensis*, L., in stored chick-peas [*Cicer arietinum*] ; the Pyralids, *Diatraea saccharalis*, F., on rice, and *Corcyra cephalonica*, Stn., in chocolate ; the Tineids, *Pyroderces rileyi*, Wlsm., in stored seeds, *Homaledra sabulella*, Chamb., on coconut, and *Leucoptera coffeella*, Guér., in coffee leaves; the Coreid, *Phthia picta*, Drury, on tomato ; the Pentatomids, *Mormidea ypsilon*, L., *M. angustata*, Stål, *Solubea pugnax*, F., and *Thyanta antiguensis*, Westw. (*taeniola*, Dall.), on rice ; the Jassid, *Empoasca fabae*, Harr. (*mali*, LeB.), on beans ; the Aleurodids, *Aleurothrixus howardi*, Quaint. (parasitised by *Encarsia portoricensis*, How.), and *Tetraleurodes mori*, Quaint., on orange ; the Coccids, *Asterolecanium aureum*, Boisd., on cacao leaves, *Pseudococcus citri*, Risso, on the roots of rice, *P. nipae*, Mask., on coconut, *Pinaspis* (*Hemichionaspis*) *minor*, Mask., on grape-vine, *Aspidiotus destructor*, Sign., on guava and other plants, *Prontaspis* (*Chionaspis*) *citri*, Comst., *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) and *Lepidosaphes beckii*, Newm., on *Citrus*, and *Pulvinaria psidii*, Mask., *Saissetia*

coffeae, Wlk. (*hemisphaerica*, Targ.), *Selenaspidus* (*Pseudaonidia*) *articulatus*, Morg., and *Ischnaspis longirostris*, Sign., on coffee ; and the Aphid, *Toxoptera aurantii*, Boy. (which was attacked by *Cycloneda sanguinea*, L.) on orange.

MacDougall (R. S.). **Insect and Other Animal Pests of 1933.**—*Trans. Highl. agric. Soc. Scot.* 1934, reprint 32 pp., 9 figs. Edinburgh, 1934.

This report follows the same lines as previous ones [*R.A.E.*, A **22** 115, etc.] and includes notes on a number of insects occurring in England and Scotland. Among those to which attention has not recently been drawn are *Psila rosae*, F. (carrot fly), as a pest of celery, and *Leucoptera* (*Cemiostoma*) *laburnella*, Stn. The larvae of the latter, which has two generations in the year, mine in the leaves of *Laburnum*. Moths emerge in May and in late July ; the first generation pupates in a cocoon attached to the leaves, the second pupates on the stem or in the soil, the fully grown caterpillars having left the leaves about October.

Otter (G. W.). **On the Early Stages of** *Lestodiplosis alvei* **Barnes (Diptera, Cecidomyidae), especially in Relation to the Larval Head Capsule.**—*Parasitology* **26** no. 4 pp. 582–593, 15 figs., 12 refs. Cambridge, 9th November 1934.

A detailed description, with special reference to the structure of the head capsule, is given of the larva of *Lestodiplosis alvei*, Barnes [see next paper], together with a brief note on the pupa. The larvae of this Cecidomyiid were found in January 1933 in two old beehives from Sussex. The bees in these hives had all died from an unknown cause about 4 months previously. Pupae of *Megaselia* (*Aphiochaeta*) *rufipes*, Mg., larvae and adults of several Coleoptera, a few larvae of *Achroia* (*Meliphora*) *grisella*, F. (wax moth), and mites of the genera *Bdella*, *Cheyletus* and *Tyroglyphus* were also present in the hives. The larvae of *L. alvei* were sluggish and were observed sucking the contents of mites, which were impaled on the hook-like mandibles. In confined conditions the larvae fed on one another. They were more abundant round and within the burrows of *A. grisella* than in the surrounding wax, probably because there were more mites around the latter's excreta than elsewhere. The technique used in rearing them is briefly described.

Barnes (H. F.). *Lestodiplosis alvei* **sp. n. (Diptera, Cecidomyidae).**—*Parasitology* **26** no. 4 pp. 594–595. Cambridge, 9th November 1934.

Adults of both sexes are described of the Cecidomyiid, *Lestodiplosis alvei*, sp. n., reared from larvae from old beehives infested with mites in Sussex [see preceding abstract].

Paillot (A.). **Nouvelles observations sur le traitement d'hiver des arbres fruitiers par les émulsions d'huile d'anthracène.**—*C. R. Acad. Agric. Fr.* **20** no. 25 pp. 815–821. Paris, 1934.

The author concludes from laboratory experiments made with eggs of *Cheimatobia* [*brumata*, L.] that the insecticidal efficiency of tar distillates does not depend upon the amount of tar " acids " contained in

the emulsion, but rather upon the manner in which the emulsion is made and the date of its application [*R.A.E.*, A **18** 496; etc.]. In the orchard, the sprays were most effectively applied just after the buds began to split. They gave satisfactory control of *Epidiaspis leperii*, Sign. (*piricola*, del G.) on pear and apple, and of the hibernating larvae of *Recurvaria nanella*, Hb., *R. leucatella*, Cl., *Argyroploce variegana*, Hb., and *Eucosma* (*Spilonota*) *ocellana*, Schiff., on apple, but not of those of *Cydia* (*Carpocapsa*) *pomonella*, L., and *Phycita spissicella*, F. It was pointed out in the discussion that the sprays render grass growing beneath orchard trees unsuitable for cattle.

Ripper (W.). **Der " falsche Drahtwurm " von** *Pedinus femoralis* **L. (Kleiner Stinkkäfer).** [The false Wireworm of *P. femoralis*.]—*Neuheiten PflSch.* **27** no. 5 pp. 113–114. Vienna, October 1934.

The larvae of the Tenebrionid, *Pedinus femoralis*, L., are recorded as attacking the roots of grasses in Austria. They were also observed among wireworms on field crops.

Haupfleisch (K.). **Schäden durch den Taxuskäfer.** [Injuries by the Yew Weevil.]—*Gartenwelt* **37** p. 626, 1 fig., 1933. (Abstr. in *Neuheiten PflSch.* **27** no. 5 p. 125. Vienna, October 1934.)

In Schleswig-Holstein the larvae of *Otiorrhynchus sulcatus*, F., are often abundant in May on the roots of yews (*Taxus*). The adults appear towards the end of June and feed by night on the bark of the shoots, causing them to wither. The larvae can be destroyed by soil fumigation with carbon bisulphide, used at the rate of about 1 fl. oz. to 12 sq. ft., and the adults can be trapped in shelters of moss or leaves.

Guran (I.). **Observatiuni asupra atacului Scolytidaelor ulmului.** [Observations on the Infestation of Elms by Scolytids.]—*Rev. Padurilor* **45** pp. 225–236, 7 figs., 1933. (Abstr. in *Neuheiten PflSch.* **27** no. 5 p. 126. Vienna, October 1934.)

An account is given of the bionomics of *Scolytus* (*Eccoptogaster*) *scolytus*, F., *S.* (*E.*) *multistriatus*, Marsh., and *Hylesinus* (*Pteleobius*) *vittatus*, F., infesting elms in Rumania, and trap-logs are recommended for their control.

Behrndt (G.). **Die Bedeutung der roten Waldameise bei Forleulenkalamitäten.** [The Importance of the red Forest Ant in Outbreaks of the Pine Moth.]—*Z. Forst- u. Jagdw.* **65** pp. 479–498, 1933. (Abstr. in *Neuheiten PflSch.* **27** no. 5 p. 128. Vienna, October 1934.)

Observations in Germany showed that there was less oviposition by *Panolis flammea*, Schiff. (*piniperda*, Panz.), on pines near the nests of *Formica rufa*, L., because the ants disturbed the ovipositing females. During the first three weeks of larval feeding, 112,000 larvae were destroyed by the ants from a nest of medium size. In a locality where pines were defoliated by the larvae, an area of about 20 yards radius round a nest was completely untouched.

Marek (—). **Die biologische Bekämpfung der Blutlaus.** [Biological Control of the Woolly Aphis.]—*Landwirtsch.*, Vienna, 1933, pp. 323–325, 3 figs. (Abstr. in *Neuheiten PflSch.* **27** no. 5 p. 128. Vienna, October 1934.)

Following its introduction into Austria for the control of the woolly apple aphis [*Eriosoma lanigerum*, Hsm.], *Aphelinus mali*, Hald., only survived the winter of 1932–33 in small numbers, and did not increase in spring owing to damp, cold weather. In June 1933 some of the parasites were released on infested apple trees that had been covered by a tent (about 6 yards long and 4 yards wide) as a protection against the inclement weather. The first parasitised Aphids were observed on 4th July, and in spite of severe frosts the parasites were still present at the end of October. Owing to the higher temperature under the tents, they completed development in about 30 days.

Hase (A.). **Ueber die Dauerwirkung des Mottenschutzes durch Eulan. IV. Teil. Ueber "Eulan AL", ein für die Chemischwäscherei geeignetes Eulan.** [On the lasting Effect of Eulan. Part iv. On "Eulan AL", an "Eulan" suitable for Application by Means of the Dry-cleaning Process.]—*Anz. Schädlingsk.* **10** no. 11 pp. 123–134, 6 figs., 10 refs. Berlin, November 1934.

This fourth part of a report on the effect of the treatment of woollen materials against *Tineola biselliella*, Humm., with "Eulan" [*cf. R.A.E.*, A **21** 497] describes in detail successful tests with "Eulan AL," which is specially adapted for application in non-aqueous solutions.

Beier (M.). **Orthopteroidea II. Phasmodea. Saltatoria.**—*Biol. Tiere Deutschlands*, Teil 26 pp. 233–415, 164 figs., 8 pp. refs. Berlin, Borntraeger, November 1934. Subscription Price *M.* 13·20 ; single copies *M.* 16·50.

In this second part on the Orthopteroidea [*cf. R.A.E.*, A **22** 229], a general account is given of the morphology and bionomics of crickets, locusts and grasshoppers occurring in Germany.

Thiem (H.) & Gerneck (R.). **Verbreitung, Entwicklung und Bestimmung der bisher in Deutschland aufgefundenen Austernschildläuse (Aspidiotini) unter Einschluss der roten Austernschildlaus (*Epidiaspis betulae*) und der San José-Schildlaus (*Aspidiotus perniciosus*).** [Distribution, Development and Determination of the Oyster-shell Scales of the Genus *Aspidiotus* hitherto found in Germany, as well as of the Red Oyster-shell Scale, *E. leperii*, Sign., and the San José Scale, *A. perniciosus*, Comst.]—*Z. PflKrankh.* **44** no. 11 pp. 529–555, 3 figs., 2 pp. refs. Stuttgart, 1934.

This paper supplements a morphological study of the same species [*R.A.E.*, A **22** 661], and comprises an account of their geographical distribution and bionomics. Keys are given to the mature females of all the species and to the second-instar larvae of *Aspidiotus ostreaeformis*, Curt., and *A. pyri*, Licht.

Hargreaves (H.). **Report of the Government Entomologist for 1933.**—*Rep. Dep. Agric. Uganda 1933* pt. 2 pp. 45–47. Entebbe 1934.

During 1933 there was a marked extension [*cf. R.A.E.*, A **22** 197] to the south and east of areas infested by the pink bollworm [*Platyedra gossypiella*, Saund.]. A survey indicates that extensive transport of seed cotton for ginning is the chief cause of its spread. The enforcement of a close-season for cotton is of great importance. Observations showed that *Lygus* [*vosseleri*, Popp.] requires soft plant tissue for successful oviposition and that eggs are mostly inserted in the distal $\frac{1}{4}$ in. of the petiole and the base of young bolls. Heavy infestation by a mite that feeds on the lower surface of the leaves and covers them with silk webs occurred during dry weather on weak cotton plants growing in poor, shallow soil.

Coffee pests observed, in addition to some of those already noticed [*loc. cit.*] were *Dasus* (*Gonocephalum*) *simplex*, F., *Jamesonia* sp., *Bixadus sierricola*, White, *Pseudococcus lilacinus*, Ckll., *P. citri*, Risso, *Lycedocoris mimeticus*, R. & P., and *Cephonodes hylas*, L. An unidentified Lamiid was found on orange trees, boring in the bark and entering the wood for short distances to pupate. The infested trees were 20 years old and were suffering severely from the effects of bark disease. Among other pests observed were the Anobiid, *Catorama* (*Cathorama*) *herbarium*, Gorh., boring in books and papers, *Acraea acerata*, How., and *Herse convulvuli*, L., on sweet potato, and *Epilachna similis*, Thunb., on rice. Two parasitic flies, a Conopid and the Tachinid, *Rondanioestrus apivorus*, Villen., caused the death of large numbers of hybrid worker bees obtained by crossing local wild bees with Italian queens. The local wild bees were also parasitised by the Tachinid, but not to the same extent.

Infestation by *Locusta migratoria migratorioides*, Rch. & Frm., continued, but damage to crops was local and negligible. One swarm of *Nomadacris septemfasciata*, Serv., which had not previously been observed breeding in Uganda, was recorded in the south-west of the Protectorate towards the end of the year. A small scattered oviposition occurred. The hoppers developed slowly and in their later instars exhibited colouring typical of the solitary phase; many were killed by birds and only a few reached the adult stage.

Masi (L.). **Descrizione di alcuni Calcididi del Marocco.** [Descriptions of some Chalcidoids from Morocco.]—*Boll. Soc. ent. ital.* **66** no. 6 pp. 97–102. Genoa, 20th June 1934. [Recd. November 1934.]

The new species described, all from oases in the Moroccan Sahara, are the Pteromalid, *Dinarmus regnieri*, of which only a single female was obtained, from a batch of the Cerambycid, *Hesperophanes fasciculatus*, Fald., and of the Scolytid, *Hypoborus ficus*, Er., which infest fig trees; the Encyrtid, *Prochiloneurus rungsi*, from an undescribed species of *Eriococcus*; the Aphelinid, *Pteroptrix maura*, from *Aspidiotus* (*Hemiberlesia*) *ceardi*, Balachowsky, on olive trees; and the Eulophid, *Tetracampe nomocera*, from *Phytomyza atricornis*, Mg., on peas.

MARIANI (M.). **Una grave infestione di** *Sesamia vuteria* **Stoll** (*nonagrioides* **Lef.) in provincia di Messina.** [A severe Infestation by *S. vuteria* in the Province of Messina.]—*Boll. Soc. ent. ital.* **66** no. 6 pp. 128–130. Genoa, 20th June 1934. [Recd. November 134.]

A serious infestation of wheat in Sicily by *Sesamia vuteria*, Stoll, a destructive pest of maize that has been confused with *Cirphis* (*Leucania*) *zeae*, Dup. [*cf. R.A.E.*, A **21** 642] was investigated in 1933–34. The larvae were found in the stems of wheat that was still green. The injury was more severe than in maize, owing to the small diameter of the wheat stem, and the ears at once withered and died. When the larva has reached a certain size, it bores its way out and then attacks a healthy stem, entering near the terminal node. It pupates in the stem, the large exit hole prepared for the adult causing the stem to break below the terminal node. Some stems harboured three or four larvae. There were continuous overlapping generations from March to October, so that all stages were present together. Burning the wheat stubble is not an adequate control, because those insects that are not destroyed in the burning may produce another generation on the maize that is sown after the harvesting of the wheat. It is suggested that maize should be replaced by another crop, and that any that is grown should be cut at once and used for fodder.

TRAINA (S.). **Persistenza dell'infezione di** *Sitotroga cerealella* **Oliv. e di** *Sitodrepa panicea* **L. in orzo e grano conservati in particolari condizioni.** [Persistence of Infestation by *Sitotroga cerealella* and *Sitodrepa panicea* in Barley and Wheat kept in special Conditions.] —*Boll. Soc. Sci. nat. econ. Palermo* N.S. **15** (1933) pp. 28–32, 2 refs. Palermo, 1934.

Samples of barley that had been kept since the summer of 1925 in wide-mouthed glass jars closed with gauze were found in November 1931 to contain dead examples both of *Sitotroga cerealella*, Ol. (which had been observed alive in the samples in previous years) and of *Sitodrepa panicea*, L. There were also 10 dead and 8 living individuals of a Pteromalid, *Dibrachys* sp.

Similar samples of wheat in the same conditions yielded examples of *Sitotroga* for 8 consecutive years. As the containers reproduced the conditions in warehouses, the need for maintaining clean conditions in the latter is evident.

HART (P. C.). **Proeven omtrent topboorderbestrijding in aanplant 1932–'33.** [Experiments on combating the Tip Borer in Sugar-cane in 1932–33.]—*Arch. Suikerind. Ned. Indië*, 1934, pp. 675–713 ; also as *Meded. Proefst. Java-Suikerind.*, 1934, no. 19. Surabaya, 1934.

For the fourth year in succession, experiments have been made in Java in cutting out infested shoots as a measure against *Scirpophaga intacta*, Sn., on sugar-cane [*R.A.E.*, A **21** 361 ; etc.]. It is concluded from a detailed discussion that on the northern coast this control can reduce the final amount of infestation by 50 per cent. and the injury by more than 75 per cent. with a resulting increase in production of 7–8 per cent. It is much less successful in the Vorstenland district of Java.

Betrem (J. G.). **Witte luis en klimaat.** [Mealybugs and Climate.]—*Bergcultures* **8** no. 34 pp. 797–804, 7 figs. Batavia, 1934.

The results of an investigation in 1933 and 1934 of the ecoclimate of coffee plantations in Java in connection with attack by mealybugs [*Ferrisiana virgata*, Ckll., and *Pseudococcus* spp. (*cf. R.A.E.*, A **20** 559; **21** 103)] are discussed in detail. It is concluded that the mealybugs can be distributed from plant to plant by heavy rain, but that their rate of increase is reduced by high atmospheric humidity, particularly if they are exposed to it in the second half of the day. The fact that infestation does not increase so rapidly in plantations under heavy shade is presumably due to the higher humidity there, but as deep shade reduces the number of coffee berries in the clusters, it is necessary to investigate its exact effect on the plants before it can be suggested for control.

Tubbs (F. R.). **The Effect of Pruning on the Occurrence of Tea Tortrix** (*Homona coffearia*).—*Tea Quart.* **7** pt. 3 pp. 146–150, 2 graphs. St Coombs, Talawakelle, September 1934.

In Ceylon during 1931–32, 54 plots of tea bushes were pruned, 18 in September, 18 in January and 18 in May, and the effect of this on the incidence of *Homona coffearia*, Nietn., during 1932–33 was noted. The numbers of egg-masses collected between 17th September and 19th December 1932 from each series of plots expressed as percentages of the mean were 122·2, 114·3 and 63·5 respectively, showing a significant reduction on plots pruned at the end of the tortrix season (May) [*cf. R.A.E.*, A **22** 167]. Conditions adverse to the moth tended to equalise the infestations on the plots in and after December, so that the effects of pruning disappeared. Differences in infestation resulting from different methods of pruning were only significant on the plots pruned in September, on which infestation was about 50 per cent. higher when methods other than clean pruning were employed. It is doubtful whether re-infestation is caused by the rapid increase of survivors from a previous season or by migration from surrounding plantations; the rate of movement is, however, very small, and the evidence for 1932–33 indicates that re-infestations were probably established by the first method. If this is so, careful collection of egg-masses and larvae is necessary even at the height of the south-west monsoon.

Marchionatto (J. B.). **Algunos hongos entomógenos comunes en la República Argentina y las posibilidades de su aplicación agrícola.** [Some entomogenous Fungi common in Argentina and the Possibilities of their Application to Agriculture.]—*Rev. Fac. Agron. B. Aires* **7** no. 3 pp. 571–584, 8 figs., 5 refs. Buenos Aires, 1934.

Fungi found infesting insects in Argentina were: *Beauveria globulifera* on the larvae of *Meroleuca* (*Dirphia*) *lauta*, Berg, *Oeceticus geyeri*, Berg, and *Phytometra* (*Plusia*) *nu*, Gn. (infections of *P. nu*, *Colias lesbia*, F., and *Schistocerca paranensis*, Burm., with pure cultures being successful); *Cephalosporium lecanii* on *Mesolecanium deltae*, Lizer, *Lecanium persicae*, F., and *Saissetia oleae*, Bern.; *Ophionectria coccicola* on *Lepidosaphes beckii*, Newm.; *Sporotrichum paranense* [*R.A.E.*, A **22** 351] on *Schistocerca paranensis*; *Myriangium duriaei* (previously found to destroy numbers of *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask.) and *Peziotrichum saccardinum*, both on *Aspidiotus perniciosus*, Comst.;

and *Sphaerostilbe coccophila* on *Aonidiella aurantii*. *Peziotrichum saccardinum* was found to be a true parasite of *Aspidiotus*, but its rapid development sometimes injured the branches of the fruit trees on which the scale occurred. Brief descriptions are given of these fungi, together with pertinent references. Possible methods of using some of them against insect pests are discussed, and it is considered that satisfactory results may be expected where the host is present in large numbers, and where the atmospheric humidity is high.

Jones (H. A.). **Lonchocarpic Acid, a new Compound from a Species of** *Lonchocarpus*.—*J. Amer. chem. Soc.* **56** pp. 1247–1248. Easton, Pa, 1934.

During investigations on the rotenone content of undetermined species of *Lonchocarpus* from Venezuela, a new compound was extracted to which the name lonchocarpic acid has been given. The physical and chemical properties are given, and the method of preparation is described.

Janda (V.). **Ueber die Wirkung der Radiumstrahlen und des ultravioletten Lichtes auf die Färbung, Metamorphose und den Sauerstoffverbrauch der Puppen von** *Tenebrio molitor* **L.** [On the Effect of Radium Rays and of Ultraviolet Light on the Colour, Metamorphosis and Oxygen Requirement of Pupae of *T. molitor*.] —*Biol. gen.* **10** no. 2 pp. 483–520, 7 figs., 50 refs. Vienna, 1934.

The following is taken from the author's summary: Subjecting pupae of *Tenebrio molitor*, L., to unfiltered β and γ rays from a radium preparation caused dark brown markings, and so affected the mechanism of emergence that the adults, although normal, were unable to emerge. Stronger doses stopped development, although the pupae often remained alive for some time. Oxygen requirement in pupae treated with these rays was reduced. Even in strong doses, however, γ rays alone had practically no effect. The effect of ultraviolet light was similar to that of the β and γ rays, except that the oxygen requirement was increased.

Reichert (A.). **Rosenschädlinge.** [Rose Pests.]—*Kranke Pflanze* **11** no. 11 pp. 139–141, 1 pl. Dresden, November 1934.

A popular account is given of the bionomics of *Coleophora gryphipennella*, Bch., and *Typhlocyba rosae*, L., infesting roses in Germany. The larvae of the former feed, hibernate and pupate in cases made of pieces of leaf. They attack the leaves in summer without doing much harm, but, after hibernating on the lower parts of the plant, bore into the unopened leaf-buds in early spring. A short pupal period follows. In late autumn or early spring the larvae on the stems near the ground can be collected or brushed off on to the soil, which must then be dug over. *T. rosae* is usually stated to have one generation a year, but the author found that it has two, and suggests that a third may occur in favourable years. A spray of nicotine and soft-soap, applied under strong pressure, is recommended for control

Petri (L.). **Deperimenti di viti in Puglia causati da un'acariosi.** [Unhealthy Conditions of Grape-vines in Apulia caused by Mites.]—*Boll. staz. Pat. veg.* **14** no. 3 pp. 382–388, 4 figs., 5 refs. Rome, 1934. (With a Summary in English.)

Cases are described of injury to grape-vines caused by the larvae of a mite and resulting in the production of dwarfed leaves. No adults of the mite were found, but as the symptoms appeared in summer, the species concerned is thought not to be *Phyllocoptes vitis*, Nal., which is usually injurious in spring.

Morris (H. M.). **Annual Report of the Entomologist for 1933.**—*Rep. Dep. Agric. Cyprus 1933* pp. 43–47. Nicosia, 1934.

In 1933, the first hoppers of *Dociostaurus maroccanus*, Thnbg., were reported in Cyprus on 16th March, but the population was considerably smaller than in 1932. *Aleurolobus olivinus*, Silv., was more numerous than usual on olive trees in one locality, but did not cause appreciable damage. *Aegeria myopaeformis*, Bkh., appeared to be fairly generally distributed, and caused serious injury to trunks of fruit trees. *Hyponomeuta padellus*, L., attacked apple and plum in spring, and sprays were applied in one area. Experiments were carried out against *Cydia pomonella*, L., on apples [*R.A.E.*, A **21** 642]. Larvae of *Phthorimaea operculella*, Zell. [*cf.* **22** 117] injuring potato leaves, were heavily parasitised by the Ichneumonid, *Angitia fenestralis*, Holmgr., in the autumn, but parasitism appeared impossible when the larvae were in the tubers. In cage experiments they attacked tobacco, tomato, egg-plant [*Solanum melongena*] and Cape gooseberry [*Physalis peruviana*]. Small Lepidopterous larvae, possibly of *Anarsia lineatella*, Zell., bored into young peach shoots in early summer in one area and in another were found in small numbers on peach, plum, apricot and cherry. Small quantities of paradichlorobenzene, sealed in tunnels made by the larvae of *Zeuzera pyrina*, L., in fruit trees, gave promising results. *Theresia* (*Zygaena*) *ampelophaga*, Bayle, was injurious to vines, and *Pyrameis cardui*, L., to artichokes. Adults of the Halticid, *Podagrica malvae*, Illig., attacked young orange leaves in one district and *Hibiscus esculentus* in another. *Anthonomus pomorum*, L., destroyed a considerable proportion of the blossom on pear trees. Larvae of *Asphondylia capsici*, Barnes, caused fruits of pepper (*Capsicum annuum*) to be dwarfed and deformed. Injury to germinating melon seeds was caused by a species of *Phorbia* (*Chortophila*). Among pests intercepted in quarantine, the most noteworthy were *Lepidosaphes beckii*, Newm., on grapefruit budwood from Palestine, and *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), on mangos from Egypt.

A Government Order issued on 29th March 1933 requires the following measures to be taken against *Ceratitis capitata*, Wied., in any area that may be declared infected: daily collection of fallen fruit of a number of kinds, its destruction or use for juice extraction, the residue in the latter case being destroyed, and the use of fly traps [*cf.* **21** 301] in fruit trees from specified dates, which vary with the type of fruit.

Ii (N.). **The Biology of** *Arge similis* **Vollenhoven.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **6** no. 3 pp. 101–103. Tokyo, July 1934.

Near Tokyo, *Arge similis*, Voll., is very injurious to *Rhododendron*. It has 2–4 generations a year, the winter being passed in the prepupal stage in the cocoon. The adult sawflies begin to emerge in May, and the larvae of the last brood begin to hibernate in October. The eggs hatch in about 10 days, the larvae are full-fed in 2–4 weeks, and the pupal stage is completed in less than a week. The females, which lived for up to 16 days, or a little longer than the males, were only observed to pair once during life, and, if unfertilised, only produced males. They laid 49–88 eggs singly in the tissues of the young leaves. The larvae feed on the leaves but not on the young buds or shoots. Parasites include a Eulophid, probably of the genus *Ootetrastichus*, an Ichneumonid, a Tachinid and a fungus.

Suzuki (T.). **The Biology of** *Neodiprion sertifer* **Geof.** [*In Japanese.*] —*Oyo-Dobuts. Zasshi* **6** no. 3 pp. 103–105. Tokyo, July 1934.

In Japan, *Diprion* (*Neodiprion*) *sertifer*, Geoffr., has one generation a year, overwintering in the egg stage, and chiefly attacks young trees of *Pinus densiflora*. The larvae, which are gregarious when young, have five instars and spin their cocoons early in June. The pupal stage lasts 2 or 3 weeks, and the adults, which live about a week, emerge in October. The female lays about 40 eggs in the pine needles.

Kamiya (K.). **Food Habits of Scarabaeidae.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **6** no. 3 pp. 105–109. Tokyo, July 1934.

Near Tokyo, 5,446 Lamellicorn beetles belonging to 7 species, of which 75·8 per cent. were *Anomala rufocuprea*, Motsch., and 23·37 per cent. *A. cuprea*, Hope, were collected on grape-vines in the evening from 26th July to 12th September 1933. *A. rufocuprea* was most abundant on 10th August.

Yago (M.). **Cicadas occurring in Pear Gardens.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **6** no. 3 pp. 131–133. Tokyo, July 1934.

In recent years, Cicadids have become abundant in pear orchards in the Shizuoka Prefecture and other districts. *Graptopsaltria colorata*, Stål, is the most abundant, 1,775,000 individuals being captured during 9 days in one village, but *Platypleura kaempferi*, F., and *Cryptotympana japonensis*, Kato, are also found. These species suck sap from the trees and sometimes oviposit in fruits covered with paper bags, while the larvae feed on the roots. They also attack other fruit trees and grape-vines. The adults of *G. colorata* usually emerge in the evening and appear to prefer dead trees for oviposition; 1,000–1,200 eggs were found in the body of the female, and the average number laid together was 3·3. Collecting the adults, spraying the ground with a solution of sodium cyanide, and washing dead branches and trees with creosote give efficient control.

Sakai (K.). **On the Times of Rice Leaf-hopper Control.** [*In Japanese.*] —*Oyo-Dobuts. Zasshi* **6** no. 3 pp. 133–135. Tokyo, July 1934.

Oiling the water in the fields for the control of Homoptera on rice is said to have been adopted in Japan by K. Kuratomi over 260 years ago. Experiments show that the oil is best applied as early as 4–5 a.m. The control obtained is lower with later application and lowest with application at 2 p.m. This is apparently due to variation in the activity of the insects.

Ozaki (S.). **The Spring Emergence of the Moths of *Chilo simplex* Butl. and the Treatment of Rice Stalks.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **6** no. 3 pp. 135–140. Tokyo, July 1934.

In central Japan, the moths resulting from larvae of *Chilo simplex*, Butl., that have hibernated in rice stalks usually emerge in mid-June from stalks kept from April onwards in sunny places, and a week or two later from those kept in sheltered places or in houses. If most of them emerge in mid-June, the damage may be much reduced, since the rice seedlings are planted in late June.

Ishii (T.) & Mizutani (Y.). **The Utilisation of a Hymenopterous Parasite of the Larva of *Chilo simplex*, Butl., introduced from the Philippines.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **6** no. 3 pp. 147–148. Tokyo, July 1934.

Spathius fuscipennis, Ashm., a parasite of *Chilo simplex*, Butl., has been imported into Japan from the Philippines. Experiments show that the best temperature for rearing it is 25°C. [77°F.]; 15 males should be kept with 30 females and 50 hosts exposed to the latter. Liberations of the parasite in 1932 and 1933 have not yet shown satisfactory results. This Braconid has also been sent to Hawaii for the control of *C. simplex*.

Onoe (T.) & Misaka (K.). **The Poisonous Effect of Cyanide Gas upon the Larvae of *Chilo simplex* Butl.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **6** no. 3 pp. 148–149. Tokyo, July 1934.

When fumigated with hydrocyanic acid gas, larvae of *Chilo simplex*, Butl., become motionless before dying, but the paralysed larvae can be distinguished from the dead ones by electric stimulation. Those that move when stimulated by less than 4 volts may recover, but those that remain motionless do not.

Wille (J.). **Der " Perforador de la bellota," *Mescinia peruella* Schaus, ein wichtiger Schädling der Baumwolle in Perú (Lep. Pyralidae).** [The Boll-borer, *M. peruella*, an important Pest of Cotton in Peru.]—*Rev. Ent.* **4** no. 4 pp. 455–485, 13 figs., 9 refs. Rio de Janeiro, 31st October 1934.

In the coastal valleys of Peru, cotton is infested by a number of insects, of which the Pyralid, *Mescinia peruella*, Schaus, is the most important. Cotton is its only known food-plant. All stages are described, and a detailed account of its biology is given from laboratory and field observations near Lima over a period of four years.

In spring the eggs are laid singly on the shoots of ratoon cotton and on the terminal and lateral shoots of first year plants. The larvae

feed between the youngest leaves and then in the stems of the tender shoots, pupating inside the stem or in a mine bored into the fork of a branch. The infested shoots wither and break off. When the flower-buds and bolls appear later, the eggs are deposited on them exclusively ; those near the ground are preferred, and the egg is laid on the inner side of the bract. Flower-buds and young bolls are bored at the base and fall off, the flowers are bored, and the seeds in the half-open bolls are attacked. Mature seeds are never injured. The same larva can cause several of these forms of injury, apparently moving from one feeding place to another by night. In normally developed fields the loss of crop is not more than 2 per cent., but in late matured crops it rises to about 40 per cent.

The moths usually emerge in the early morning. During the day they remain motionless on cotton plants, dry earth or débris. They fly low between the plants, so that isolated plants are rarely infested. They pair repeatedly, beginning on the second day after emergence. The number of eggs laid by one female is estimated at 80–100. In captivity oviposition began 4 days after mating and continued for 17 days. The maximum duration of adult life was 29 days for females and 21 for males. The eggs hatched in 11 days at 18°C. [64·4°F.] and in 7 days at 25°C. [77°F.]. There are 6 larval instars, the total larval development taking 33–49 days. The larvae pupate between dead leaves, débris or lumps of earth, at less than an inch below the surface. There is a prepupal stage of 2–4 days, and the pupal stage lasts from 12 to 31 days according to the season. The total life-cycle requires 60–100 days. There are normally five generations a year, but a sixth is possible if the winter is favourable.

Of observed plants, 0·5 per cent. were infested from September to December, 1–2 in January and February, 15 in March, 20 in April, 25–30 in May, 50 in June and 80 in August. From September to February there was as a rule only one larva per plant, but in June and July there were more than three. The larvae are very sensitive to strong sunshine and to temperatures above 25°C. ; consequently infestation is most severe in winter. Although development can be completed in the shoots, stems and buds, the flower-buds and bolls are more suitable ; they are not available until December, and when infestation has reached its height, during June and July, it is almost brought to an end by the harvest. It may be further checked by cutting down and burning plants in July and August. The effect of such measures as irrigation, loosening the soil, manuring, weeding, etc., cannot be accurately determined, because other pests, such as *Dysdercus ruficollis*, L., are also checked. The nature of the soil does not seem to influence *Mescinia*. Prophylactic measures include making new sowings every year, leaving no old stems in the ground, and early sowing of rapidly maturing varieties. In large scale experiments, a very finely powdered and adhesive calcium arsenate dust produced a mortality of 74·7 per cent., and such dusting is the direct control recommended.

A number of parasitic Diptera and Hymenoptera were observed. The commonest was an Ichneumonid, *Idechthis* sp., which also attacks *Margaronia quadristigmalis*, Gn., on olive [*cf. R.A.E.*, A **20** 462]. As a rule it did not parasitise more than 10 per cent. of the larvae from December to April, and only about 0·5 per cent. in winter. Predators, including the Cicindelid, *Megacephala* (*Tetracha*) *carolina*, L. (*chilensis*, Cast.), were unimportant.

Ting (P. C.). **Back-crawling Scarabaeid Grubs** (*Potosia affinis* **Andersch**) **intercepted in Quarantine at San Francisco.**—*Mon. Bull. Calif. Dep. Agric.* **23** no. 7–9 pp. 185–191, 2 pls. Sacramento, Calif., 1934.

Ten larvae and a newly emerged adult of *Potosia affinis*, Andersch, were intercepted in California in peat packing around *Acacia* plants from Italy. This Cetoniid has not been recorded in the United States, being apparently confined to central and southern Europe and western Asia, where the adults attack the flowers of ornamental plants, especially roses, and young buds and fruit of various fruit trees. A description is given of the larva, with special reference to the head appendages.

Binney (W. S.). **The Silver or Rust Mite** *Phyllocoptes oleivorus* (**Ashm.**) **in San Diego County.**—*Mon. Bull. Calif. Dep. Agric.* **23** no. 7–9 pp. 201–203, 4 refs. Sacramento, Calif., 1934.

Phyllocoptes oleivorus, Ashm., a major pest of *Citrus* in Florida, has been known in San Diego county, California, for over 40 years, but has only caused serious injury to *Citrus* occasionally. It was not recorded as a pest after the frost of January 1913 until August 1929, when gradual loss of leaves and silvered fruit were noted in two adjacent lemon orchards. The silvered condition of lemons only lasts while the fruit is immature; the roughened skin turns brown as the fruit ripens. The silver colour is not noticed on oranges, which only show a brown "russeting." When *P. oleivorus* feeds on the leaves and twigs of the trees, the former eventually drop and the latter turn black, the bark splitting longitudinally in many places.

In April 1930, a third orchard adjacent to the others was infested, and control experiments were carried out. Tent fumigation with hydrocyanic acid gas and dusting with sulphur (1 lb. per tree) both apparently gave 100 per cent. control; sprays of oil emulsion or lime-sulphur (each at 2 per cent. strength) gave fairly good results but traces of live adults were found after treatment. Untreated trees were heavily infested during the four months of observation. The mite was widespread in the spring and summer of 1931, but owing to the cold winter of 1931–1932, it was scarce in the following spring and up till July 1933 only scattered infestations have been noticed. If they increase, sulphur dust is to be applied. This dust not only kills the mites at the time of application, but remains long enough on the tree to destroy the young as they hatch. It must be applied in absolutely calm weather, and not within 6 weeks of an oil spray.

The adults and eggs are very briefly described. The eggs hatch in 4–5 days in summer and 10 in winter, and the adult stage is reached in 4 days in summer and 6 in winter. The adult mites are parthenogenetic, and live for about a week, laying 2 or 3 eggs daily. Infestation is usually confined to parts of the tree and of individual fruits that are exposed to the sun.

Insect Pests of Dried Fruits.—*Mon. Bull. Calif. Dep. Agric.* **23** no. 7–9 pp. 204–206. Sacramento, Calif., 1934.

In the San Joaquin Valley of California, 7 species of Lepidoptera that are usually considered pests of stored products occur out of doors.

Ephestia figulilella, Gregson, comprised about 97 per cent. of the stored-product moths taken in pails of malt-syrup bait in 1931–33; the others were *E. elutella*, Hb., *E. kühniella*, Zell., *Plodia interpunctella*, Hb., *Vitula serratilineella*, Rag., *Pyralis farinalis*, L., and *Ephestiodes nigrella*, Hulst. All these species except *Pyralis* are known to occur in dried fruits in California, but only *Plodia* and *E. figulilella* are of economic importance. *Aphomia gularis*, Zell., which has been established in the San José district for several years, is a potential pest.

E. figulilella did not attract attention until 1928, but has subsequently become a very serious pest [*cf. R.A.E.*, A **22** 356]. Infestation of raisins was very severe in 1930. The larvae overwinter in stored dried fruit (particularly raisins) and in the field under the bark of grape-vines and in the soil of vineyards and fig orchards. Adults usually begin to emerge in the field in April and are present until November. Mulberries are infested in spring, a recent estimate showing that there were over 2 million small larvae per ton; later fallen apricots, peaches and first crop figs provide a succession of host fruits. Main crop figs and raisins are attacked throughout the harvest, and considerable infestation occurs in dried apricots, peaches and prunes. A few weeks after storage the fully grown larvae begin to migrate from the fruit to pupate, and by the following spring raisins become comparatively free from infestation. The numbers of the larvae are reduced by parasites, the heat of the sun and apparently low temperatures. The chief parasite is *Microbracon hebetor*, Say, others being the Ichneumonids, *Nemeritis canescens*, Grav., and *Mesostenus gracilis*, Cress. Much of the infestation has been prevented by covering fruits during and after drying with tobacco shade cloth to exclude the moths [*loc. cit.*]. In raisins that had 1,400 larvae per ton when they were covered at the time of stacking the infestation was only 2,100 per ton after drying for three days as compared with 38,400 in unprotected ones.

Coleopterous pests include *Tribolium confusum*, Duv., which appears to be of increasing importance in old raisins, and the Nitidulid, *Carpophilus hemipterus*, L., which infests figs on the trees and is probably responsible for introducing the yeasts that cause souring. Injury by *C. hemipterus* varies from year to year, and trap records for 1934 indicate the prospect of serious damage in August and September. Large numbers of adults and larvae were found in fermenting grape pomace in February and March, chiefly occurring in the outer 4 inches of crust where a temperature of 90–95°F. permitted breeding in cool weather. *Carpophilus dimidiatus*, F., and *Epuraea luteola*, Er., infest figs in much smaller numbers, and *Blapstinus fuliginosus*, Csy., occasionally causes considerable damage to the fallen fruit.

Drosophila spp. attack figs in the orchard when the temperature begins to fall and are sometimes responsible for souring.

Plank (H. K.) & Cressman (A. W.). **Some Predatory Habits of the Orange Bagworm** *Platoeceticus gloverii* **Packard.**—*Mon. Bull. Calif. Dep. Agric.* **23** no. 7–9 pp. 207–209, 1 fig. Sacramento, Calif., 1934.

Platoeceticus gloveri, Pack., has been the most important predacious enemy of *Pseudaonidia duplex*, Ckll., on camphor [*Cinnamomum camphora*] in southern Louisiana for some years. Although the larvae

of this Psychid have been recorded as injuring oranges and grapefruit in Florida [*R.A.E.*, A **11** 385], no damage to any plant has been observed in southern Louisiana, where they have also been found to attack *Saissetia oleae*, Bern., *Coccus hesperidum*, L., and *Ceroplastes* sp. The body of *Pseudaonidia* is eaten and the scale covering is added to the larval case of the Psychid, a white area, the under covering of the scale, being left. A count of these white areas indicated that up to 60 per cent. of the scales may be killed on some trees. A localised heavy infestation was reduced by over 90 per cent. in the spring of 1932, but the Psychid then almost entirely disappeared, and the scale was again abundant in June. *Platoeceticus* has recently been scarce in parks, etc., probably because the host has been controlled by regular spraying.

HOUSER (J. S.). **A new Wheat Pest in Ohio.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **19** no. 170 pp. 169–171, 1 fig. Wooster, Ohio, 1934.

In 1934, *Trachelus tabidus*, F. [*cf. R.A.E.*, A **8** 347] was found infesting wheat in Ohio, where it had not previously been recorded. The larvae began feeding inside the straw below the head and ate through the centre of each joint almost down to the soil level, where they severed the straw just before harvest time, leaving only a small length of stubble. The straw and the stubble were filled with sawdust-like frass. The larvae were found resting in silk cases, which fitted closely to the walls of the stubble. They are expected to overwinter and give rise to adults in May or June. In an attempt to estimate the extent of infestation in the eastern part of the State, 93 wheat and 4 rye fields were visited. In the most severely damaged wheat-field the infestation was 68 per cent. Two fields of rye growing in the vicinity had a 7 and 16 per cent. infestation respectively. Oats were not infested. Ploughing the stubble in autumn would probably prevent emergence, but would disturb the scheme of rotation practised in Ohio. The grain on the severed straws was of fairly good quality and would have been worth raking and harvesting.

PARKS (T. H.). **The Annual Wheat Insect Survey with Special Reference to the Hessian Fly Situation, 1934.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **19** no. 170 pp. 171–174, 3 figs. Wooster, Ohio, 1934.

The average infestation of wheat throughout Ohio by the Hessian fly [*Mayetiola destructor*, Say] in 1934 was 15·5 per cent. as compared with 8·1 per cent. in 1933 [*R.A.E.*, A **21** 596]. In one county, the percentage infestation was 70 in 3 fields planted 2 or 3 days before the suggested date, but was as high as 32 in fields planted later, a situation only accounted for by the great increase of the spring brood originating from adults that emerged from early-sown and self-sown wheat. Strict observance of correct sowing dates is again recommended.

The chinch bug [*Blissus leucopterus*, Say] developed in wheat and rye during May and June, but only caused injury, by sucking sap from the roots and stems, in heavily populated fields. At the wheat harvest they began to migrate to maize or oats.

ROARK (R. C.). **Devil's Shoestring** (*Cracca virginiana* **L.). A Potential Source of Rotenone and Related Insecticides.**—12 pp. multigraph, 6 pp. refs. Washington, D.C., U.S. Dep. Agric., Bur. Chem., June 1934. [Recd. November 1934.]

The literature on the chemistry of *Tephrosia* (*Cracca*) *virginiana* and on its use in medicine, as a fish poison, and as an insecticide [*R.A.E.*, A **19** 319] is reviewed, and descriptions of the plant are quoted. It has been found to contain rotenone in amounts ranging from 0·1 to 1 per cent., and tephrosin and related compounds have also been isolated from it. The total amount of material extracted with acetone varies from 3 to 9 per cent. Selective breeding of toxic strains may increase the insecticidal constituents in this plant, and it may become commercially important.

WEBSTER (R. L.) & MARSHALL (J.). **The Position of Nicotine in Codling Moth Control.**—*J. econ. Ent.* **27** no. 5 pp. 873–878, 3 refs. Geneva, N.Y., October 1934.

An account is given of investigations carried out in Washington State since 1927 on nicotine sulphate as a substitute for lead arsenate in the control of the codling moth [*Cydia pomonella*, L.] on apple. The following is substantially the authors' summary, the quantities of insecticides shown being those used to 100 U.S. gals. water : When nicotine sulphate (1½ U.S. pints) was used in place of lead arsenate (2 lb.) in the second and third cover sprays in 1927, less efficient control was secured, especially in the case of Spitzenburg apples. Nicotine sulphate (⅛ U.S. pint) was much less efficient than lead arsenate (2 lb.), when both were applied throughout the season to Rome apples in 1928. An oil-nicotine combination (1 U.S. gal. summer oil, ½ U.S. pt. nicotine sulphate) used throughout the season resulted in slightly better control than lead arsenate (2 lb.) on Romes in 1928, and gave approximately equal results in 1929. The same combination used in the last two cover sprays on Jonathans in 1929 gave improved control over lead arsenate (2 lb.). When used in the last two cover sprays on Romes in 1930, oil-nicotine gave only slightly better control than lead arsenate (3 lb.). On Jonathans in 1930, oil-nicotine in the last two cover sprays, oil and lead arsenate in the second cover and lead arsenate (3 lb.) otherwise, gave results only slightly better than lead arsenate, and in 1931 oil-nicotine in the last two cover sprays on Romes was practically equivalent to lead arsenate, probably because of larval activity late in the season. In 1932, when heavy infestation resulted in a high percentage of infested apples on all sprayed plots, there was little difference in control on Romes between oil-nicotine in late cover sprays and lead arsenate (3 lb.) throughout the season. Both in 1931 and 1932 there was little difference in control on Romes when oil and nicotine tannate (1 lb. tannic acid, ½ U.S. pint 50 per cent. nicotine, and ⅕ U.S. gal. oil emulsified with casein-ammonia) was used for the last two cover sprays, as compared with lead arsenate (3 lb.) used throughout the season.

In a spray schedule of oil-nicotine in the last 3 cover sprays, lead arsenate (2 lb.) and oil in the second cover and lead arsenate (3 lb.) in the remaining cover sprays, control of *C. pomonella* was greatly improved over lead arsenate (3 lb.) for six cover sprays on Delicious

apples in 1933. The application of mineral oil following lead arsenate earlier in the season made the removal of lead residues more difficult than when lead arsenate was applied alone throughout the season.

BAILEY (S. F.). **Factors influencing Pear Thrips Abundance and Effectiveness of Cultural Control.**—*J. econ. Ent.* **27** no. 5 pp. 879–884, 4 refs. Geneva, N.Y., October 1934.

In view of variable results obtained from methods practised for the control of *Taeniothrips inconsequens*, Uzel, in California, and difficulties in attempting to forecast outbreaks, owing to variations in soil type, cultural practices and local migrations, studies have been made of the principal factors influencing the immature stages of the thrips. Apart from the established fact that an unusual amount of rain in April and May or in September and October materially lessens infestation in the following spring, phenological indicators of a practical nature are unknown. Although weather conditions in winter appear to have very little effect on the adults in the soil, emergence, which takes place in February and March in California, seems to be directly influenced by soil temperature [*cf. R.A.E.*, A **3** 462, etc.]. Significant emergence (5 adults per square yard per day) began in 1933 after 3 consecutive days of mean soil temperature above 54°F. (taken at a depth of 6 ins.), and in 1934 after 2 consecutive days of mean soil temperature above 54°F. In silt-loam soil, most of the thrips overwintered at 6–7 inches. Emergence begins earliest in the lighter soils, individuals nearest the surface coming out first. Early spring ploughing hastens emergence, whereas a heavy cover crop keeps the soil cooler and retards emergence for several days. Feeding and oviposition after emergence are influenced chiefly by food supply and atmospheric conditions. The stage of development and rate of growth of the buds in the orchard largely determine the amount of injury. Thus the first adults emerging in a prune orchard, finding the buds insufficiently open, will migrate to an adjacent pear orchard and join the adults emerging there in attacking the pear buds. Adults emerging later under prune trees find the buds sufficiently advanced and remain there. If no fruit buds were available, the adults would migrate to other food-plants. If a relatively long time elapses between the green-bud stage and full bloom, and if the peak of emergence has been reached, severe injury results, and the migration of adults may produce unforeseen infestations.

Larval infestation may be reduced by the fall of flowers and small fruits where many eggs have been laid in the stems, and by heavy rain washing off immature larvae. The depth to which the fully-grown larvae descend depends upon the type of soil, the greatest depth being reached in open porous soil. Mechanical disturbance of the soil before they have constructed their cells crushes and kills many. As a sandy soil unprotected by heavy shade dries out during the summer, the thrips' cells gradually crumble and the larvae die, but in a clay type of soil there is a tendency to bake hard and in this case the larvae shrivel up inside their cells. Heavy soil that remains cool and moist offers optimum conditions for the aestivating larvae, and any cultural practice that disturbs and aerates the soil produces a very high mortality. Data obtained in the laboratory indicate that soil moisture is relatively more important than soil temperature, the larvae being unable to survive more than 3 days if the soil moisture

falls below 9 per cent. (dry weight basis) regardless of variations in soil temperature (42–100°F.). Optimum conditions appear to obtain between 10 and 13 per cent. soil moisture ; in saturated soil (29·6 per cent. moisture) at 77°F., the average mortality over a 24-day period was 93·2 per cent. The percentage mortality over a 30-day period in soil of 12·6 per cent. moisture content increased from 14·4 at 42°F. to 100 at 100°F. Submergence in water at room temperature killed all mature larvae in 3 days and all pupae in 20 hours.

Pupation usually occurs in October, the pupae being subject to the same soil factors as the larvae, and apparently suffering a much higher mortality. The efficiency of autumn ploughing depends on the time and type of ploughing and on the soil factors. It appears that soil temperature below 70°F. together with optimum moisture conditions is required for pupation. This condition is first approached in the heavy soils. The pupae are very susceptible to drying out ; all died in 20 hours in air-dry clay soil (4·6 per cent. moisture) at room temperature. The effectiveness of autumn irrigation against the pupae depends upon the percentage of thrips actually in the pupal stage at the time of application, the method of irrigation employed, the amount of water applied, and the water-holding capacity of the soil. Although it is doubtful whether the thrips are actually drowned, the longer a soil can be held at its field capacity, or nearly so, the greater is the mortality.

Wymore (F. H.). **Cicadas in Relation to Agriculture.**—*J. econ. Ent.* **27** no. 5 pp. 884–891, 15 refs. Geneva, N.Y., October 1934.

Injuries to cultivated plants by Cicadids in all parts of the world from 1846 to 1932 and the measures employed for their control are reviewed. Species recorded from California include *Tibicen* (*Diceroprocta*) *apache*, Davis, which breeds commonly in thickets of mesquite [*Prosopis*] in the Coachella and Imperial Valleys, but readily adapts itself to cultivated plants such as *Citrus*, the twigs of which are killed by oviposition wounds, and asparagus ; *Platypedia areolata*, Uhl., and *P. minor*, Uhl., which are sometimes abundant enough to cause serious injury by ovipositing in fruit trees in the coastal areas of Central California ; and *Clidophleps distanti*, Van D., which shows a preference for ovipositing in year-old apricot wood and has caused noticeable damage in the Sacramento Valley, also being observed to oviposit in grape-vines and cherry as well as in native plants. Asparagus plants the roots of which were infested by *T. apache* died out completely after a season or two. When full-grown nymphs from infested asparagus plants were placed on the root of a lucerne plant, the leaves began to take on a mottled appearance within 2 weeks and 10 days later the whole plant had wilted down and was completely destroyed. This reaction is unlikely to have been produced by mere sucking of the sap, and it is suggested that some organism may have gained entrance through the feeding punctures of the Cicadid nymphs.

Mason (A. C.). **Some Methods for Shipping, Feeding and Rearing Fruit-fly Parasites.**—*J. econ. Ent.* **27** no. 5 pp. 891–897, 2 refs. Geneva, N.Y., October 1934.

In Hawaii, *Ceratitis capitata*, Wied., is parasitised by the Braconids, *Opius humilis*, Silv., *Diachasma tryoni*, Cam., and *D. fullawayi*, Silv.,

and by the Eulophid, *Tetrastichus giffardianus*, Silv., the combined activity of which, as shown by records from 1914 to 1924, accounts for 50 per cent. of all fruit-fly larvae, about 4 years being required to reach this degree of parasitism. All these parasites were introduced into the Islands in 1913–14.

The following is mainly taken from the author's summary of studies on methods of shipping, feeding and rearing these parasites, consignments of which have been sent to various countries against *C. capitata* and other fruit-flies. The adults are able to withstand refrigeration at 44–50°F. for 10 days without food, or for many weeks if removed to room temperatures at intervals of 6–10 days and fed with honey solution (1 part strained honey to 2 parts water). Droplets of this material are placed on a fresh leaf or a sheet of paraffined paper and inserted into the parasite cage. Cube cane sugar and a nearly dry mixture of honey and powdered cane sugar are also satisfactory foods. When dry food is used, water is also supplied, by means of a self-feeding bottle, but care must be taken to avoid excess humidity. Adults of these parasites so shipped produced normal offspring. Parasitised pupae can be kept at 55–60°F. for 35–50 days before any emergence takes place and with little mortality, but it is considered dangerous to import this stage into or through uninfested areas [*cf. R.A.E.*, A **21** 304]. Storage at ordinary food-refrigeration temperatures (36–41°F.) kills a large percentage of both pupae and adults in a few days.

The Braconid parasites oviposit within 24 hours on well developed larvae of the fruit-fly in small fruits placed in cages in the laboratory. The fruits should then be removed and kept over sand until the larvae have emerged and pupated. Unlike the adults of *T. giffardianus*, the Braconids will only parasitise host larvae in the fruits. When reared under laboratory conditions there is a tendency for only males to be produced, so that at least a part of any consignment of parasites should be placed in a large screened cage over a tree containing infested fruits, so that natural conditions may be provided and the parasites recovered.

The author records that by these methods adults have been successfully sent from Hawaii to California and to Spain [**22** 607]. Several successful shipments of parasitised fruit-fly puparia have also been sent to Australia.

Mason (A. C.) & McBride (O. C.). **Effect of Low Temperatures on the Mediterranean Fruit Fly in infested Fruit.**—*J. econ. Ent.* **27** no. 5 pp. 897–902, 6 refs. Geneva, N.Y., October 1934.

The following is taken from the authors' discussion of this paper, which is a preliminary report on the results of tests in Honolulu to determine the time-temperature values necessary to ensure mortality within the fruits of all living stages of *Ceratitis capitata*, Wied. Data compiled from experiments with over 500,000 eggs and larvae showed that complete mortality can be obtained after exposure for 8–11 days to a temperature of 29–31°F. These results support for the most part the findings of other workers, which are briefly reviewed [*R.A.E.*, A **19** 471, etc.]. Small variations in temperature above the prescribed point for a part of the period did not greatly prolong the life of the insects. Although all the experiments were carried out at temperatures below freezing point and show the time for complete mortality to

range from 18 hours at 10°F. to 11 days at 31°F., the results confirm those of workers [**4** 124] who obtained survivals at 32°F. of 6 out of 332 third-instar larvae treated for 11 days, but none from 626 third-instar larvae treated for 12–15 days. As the temperature was raised, the time for complete mortality increased until 46 days were required at 40–45°F. These combinations of periods of exposure and temperatures are well within the limits of practical storage for many fruits under normal conditions, and will ensure their freedom from any form of *C. capitata*.

Studies to determine the effects of cold treatment on the fruits showed that many kinds broke down rapidly when returned to normal temperatures if they were overripe when placed in storage, but if firm and solid they usually withstood the treatment at 29–31°F. for 10–15 days without injury. This was particularly true of juicy fruits, such as *Citrus*, guavas and mangos, but some of the smaller less juicy fruits such as kamani nuts (*Terminalia catappa*), coffee berries and loquats, had a tendency to turn brown and have a scalded appearance after several days in cold storage. The only fruit of commercial importance seriously affected by cold treatment was the avocado, which, regardless of the stage of maturity, became discoloured and bitter after several days exposure at temperatures of about 30°F.

McBride (O. C.) & Mason (A. C.). **The Effect of subfreezing Temperatures on the Mango Weevil.**—*J. econ. Ent.* **27** no. 5 pp. 902–907, 8 refs. Geneva, N.Y., October 1934.

As the larvae and pupae of *Cryptorrhynchus* (*Sternochelus*) *mangiferae*, F., a pest of mango in Hawaii [*R.A.E.*, A **18** 342], develop in the seeds within the fruits, all stages may be readily transported in commerce. Studies have therefore been carried out to determine the lowest fatal combinations of time and temperature exposures necessary to kill the different stages within seeds from which the flesh had been removed. Although the physiological effect of freezing was not considered, the weevil, a tropical species living in Hawaii at temperatures varying from about 58 to 85°F., exhibited cold-hardiness characteristics similar in many respects to those of insects of the temperate zone. In mango seeds collected during October and November and exposed to 10°F., 24 hours' exposure killed 30·5 per cent. of the adults and 50 per cent. of the pupae, and 48 hours' exposure destroyed all the larvae and pupae, but only 77·7 per cent. of the adults, complete mortality of the latter occurring only after 5 days. At 30°F. no larvae survived after 30 days and no pupae after 40, but 15·3 per cent. of the adults survived after 50 days' exposure. Marked seasonal differences were observed between collections made in August and in October–November. In August, 10 days' exposure to 20°F. killed 73 per cent. of the adults, and none survived after 14 days; but in October–November, an exposure of 10 days killed only 35·5 per cent., and complete mortality was reached only after 24 days.

Keck (C. B.). **Relation of Oviposition Punctures of the Mediterranean Fruit Fly to the premature Dropping of *Citrus* Fruits. Preliminary Report.**—*J. econ. Ent.* **27** no. 5 pp. 908–914, 2 graphs, 2 refs. Geneva, N.Y., October 1934.

During tests in Hawaii in 1931 and 1932 to determine the relative susceptibility of the fruits of different varieties of *Citrus* to attack by

Ceratitis capitata, Wied., in which samples taken at 10-day intervals throughout the autumn and winter season were kept for infestation records, it was noted that all the fruits in the grove had dropped to the ground and decayed within 40 days from the time they began to ripen, the dropping of the fruit being correlated with the oviposition punctures of *C. capitata*. When *Citrus* trees were screened, the fruits remained on them several months longer than on unscreened trees. Of the organisms found associated with the fruit-fly punctures, *Penicillium digitatum*, the common olive green mould of *Citrus*, appeared to be capable of causing the fruits to drop soon after infection. Ovipositors of females of *C. capitata* collected in *Citrus* groves were found to be contaminated with the spores of this fungus. Some data indicated that the fruit-fly may inoculate the fruit with the spores at the time of oviposition. As the mould produces a considerable area of soft rot within 3 days after inoculation, it would soften the rag of the rind, which is the chief factor in preventing the larvae, which hatch in 2 days at normal temperatures, from reaching the pulp. It is believed that the dropping of fruits as a direct or indirect result of oviposition punctures of *C. capitata* is the most important damage it causes to the *Citrus* crop in Hawaii.

Marlowe (R. H.) & Hong (T. H.). **The Lethal Effect of Sea Water on the Larvae of the Mediterranean Fruit Fly** (*Ceratitis capitata* **Wied.**). *J. econ. Ent.* **27** no. 5 pp. 914–919. Geneva, N.Y., October 1934.

Since decayed fruit containing the larvae of *Ceratitis capitata*, Wied., is thrown overboard from cargo vessels when approaching ports where quarantine measures are enforced, investigations were carried out in Honolulu to determine the fate of larvae in floating or submerged fruit. The results show that the larvae die or leave the fruit as it absorbs salt water. The time required for salt water to penetrate throughout infested fruit depends upon its composition and texture, and that taken to produce complete mortality of fruit-fly larvae present in it ranges from 24 to 72 hours. Guavas (*Psidium guayava*) require the least time. No living larvae were obtained from tangerines (*Citrus nobilis*), calamondins (*C. mitis*) or sour oranges (*C. aurantium*) that had been floating for 48 hours, but it was necessary to keep mangos (*Mangifera indica*), kamani nuts (*Terminalia catappa*) and sweet oranges (*C. sinensis*) in the sea for 72 hours to obtain complete mortality. When infested fruits were removed to a favourable place, the larvae emerged and completed their normal development. Larvae that leave floating fruit attempt to hold their posterior spiracles at the surface of the water and may pupate in this position. Pupae thus formed succumb after floating in salt water for 24 hours. Larvae that do not pupate in salt water become inactive, and die after being submerged for 48–60 hours. Infested fruits thrown into the sea where they may float ashore within 72 hours are therefore a potential source of infestation

Steinweden (J. B.). **Fumigation for European Earwig** (*Forficula auricularia* **Linn.**) **in balled Nursery Stock.**—*J. econ. Ent.* **27** no. 5 pp. 919–923. Geneva, N.Y., October 1934.

The results hitherto obtained in the fumigation of ornamental nursery stock against *Forficula auricularia*, L., have been unsatisfactory; only partial mortality of the earwigs was secured at San

Francisco in 1931 when 25 cc. liquid HCN was used to 100 cu. ft. for 1 hour at a vacuum of 26 inches, and in September 1933 a truckload of balled ornamental stock was severely scorched in an attempt to obtain complete mortality. Experiments were therefore made on adult earwigs with liquid HCN, calcium cyanide, paradichlorobenzene and naphthalene.

The following is mainly taken from the author's summary: In vacuum fumigation with liquid HCN of large quantities of balled evergreen nursery stock, a dosage tolerated by the plants was not strong enough to kill earwigs within the earthen balls. Some kinds of plants were able to withstand 20 cc. HCN per 100 cu. ft. for an hour, but others were injured to some extent by any dosage over 15 cc. On the other hand, some earwigs survived dosages as high as 28 cc. for 1 hour or 21 cc. for $2\frac{3}{4}$ hours. This is probably due to absorption of gas by the soil. No difference in toxicity was noted when the vacuum was held when it was broken down after the gas was drawn into the tank. The temperature should be at least 60°F.

Individual plants can be fumigated effectively and safely with calcium cyanide (Cyanogas A-dust containing 40–50 per cent. calcium cyanide) by dusting the fumigant around the ball inside the burlap covering and then wrapping the ball tightly in a rubber tarpaulin. The amount of calcium cyanide will vary with the size of the plant, but $\frac{3}{4}$ oz. is recommended for a medium sized plant for a fumigation time of 24 hours. Paradichlorobenzene used in the same manner at the rate of 1 oz. for a small plant for a fumigation time of 48 hours is effective only against earwigs that are not buried in the soil. Naphthalene flakes (1 oz. to each small plant for 48–96 hours) were ineffective against earwigs in the balls.

Hoskins (W. M.) & Harrison (A. S.). **The Buffering Power of the Contents of the Ventriculus of the Honeybee and its Effect upon the Toxicity of Arsenic.**—*J. econ. Ent.* **27** no. 5 pp. 924-942, 4 figs., 28 refs. Geneva, N.Y., October 1934.

It has been shown that the toxic action to mosquito pupae of dilute solutions of arsenious acid (pH 5) is about $4\frac{1}{2}$ times as rapid as that of solutions containing the same concentrations of sodium arsenite (pH 11) [*R.A.E.*, B **21** 34]. Similar results were expected by other workers with house-flies [*Musca domestica*, L.], but no appreciable difference in toxicity was actually found. This was attributed to a buffering effect of the contents of the digestive tract of the flies [**21** 175]. Unpublished results from the authors' laboratory show that there is less difference in the toxicity to mosquito larvae of acid and basic solutions of trivalent arsenic than was found with mosquito pupae, and these results are attributed to the same cause. As there appeared to be no data in the literature by which the toxicity of an insecticide and the buffering power of the contents of the digestive tract of an insect may be correlated, a study was undertaken in which arsenic was the selected substance and the honeybee [*Apis mellifera*, L.] the insect.

The results, which are too detailed to abstract, are recorded under the following headings: Methods and Results of Experiments; Normal pH of Contents of Digestive Tract and of Body Fluid of the Honeybee (colorimetric and electrometric determinations); The Buffering Power of the Contents of the Ventriculus; Lethal Dose of Arsenic and

Comparison with other Insects ; Phosphate in Bee Blood ; Phosphate in Excreta ; Buffering Power of Ventricular Contents ; and Nature of the Unknown Buffer (the chemical identification of which is not attempted).

BALL (E. D.). **The Number of Generations of the Beet Leafhopper under natural Conditions.**—*J. econ. Ent.* **27** no. 5 pp. 945–959, 5 figs. Geneva, N.Y., October 1934.

The author reviews life-history studies of *Eutettix tenella*, Baker, made by various workers in the field in Arizona, Idaho and California and correlates them with his own observations. All agree that there is only one generation annually on beet. Although laboratory experiments indicate that the leafhoppers will continue to reproduce indefinitely if a continuous change to young and rapidly growing food-plants is provided and favourable temperatures are maintained, there is no experimental evidence to prove that they will do so when fed on normally maturing sugar-beets, or even on the more rapidly maturing vegetation of the deserts. The author's experiments in Utah confirm the results of others carried out in Idaho which show that under the local conditions leafhoppers that had matured and fed on beets in the field for many weeks before being caged did not develop eggs. Nymphs do not mature below 75°F., and throughout the beet leafhopper belt in the United States eggs are developed in the spring at temperatures between 60° and 70°F. and are laid at or above 65°, but are not hatched until temperatures well above 70° are reached. Leafhoppers begin to migrate at temperatures just below 60°, and the highest favourable temperature is about 80°. Summer temperatures in certain regions in Arizona and California are therefore inimical to the development of *E. tenella*.

Since it takes 5–7 months in summer to develop a complete generation and since the temperatures before the spring migration, even in the warmest parts of the leafhopper belt, are less than 60°F., a desert generation before the spring flight is hardly possible. The author considers that the dark and pale forms of *E. tenella*, believed by some to represent different generations [*R.A.E.*, A **18** 374] are merely the result of variations in temperature and moisture. In W. Carter's cage experiments in Idaho only dark forms were produced when the temperatures were low and the moisture high, regardless of season, whereas in Utah the production of pale forms coincided with exceptionally hot and dry years. It is also suggested that many of the so-called dark overwintering forms may undergo a change in colour in the spring as the pairing season approaches, a phenomenon common among other leafhoppers with similar life-histories.

Evidence in regard to the season at which pairing occurs is conflicting. The author's observations in Utah indicate that the two sexes appear together in the beet fields in about equal numbers and that oviposition does not begin until several days have elapsed, but workers elsewhere have recorded flights of leafhoppers that were exclusively females ready to lay eggs on arrival. The author believes that he can reconcile these two phenomena without postulating a desert generation before migration. Though, however, there is normally only a single generation on sugar beet, even in California and Arizona, there is probably a partial second generation in the desert in Arizona and in the warmer regions of California, with a more or less quiescent period of aestivation in the heat of summer and dormancy in winter. There

are many records of survival of females of *E. tenella* for more than a year, and in many desert places food-plants dry up before females have completed oviposition. Such females sometimes aestivate and begin laying eggs again when vegetation becomes available, and the author suggests that in a similar manner females stimulated to egg production in the autumn may be forced by cold to hibernate after laying only a part of their eggs. They would then overwinter with females of the second generation, which normally overwinter without becoming sexually mature, and with other females of the first generation that have not been stimulated to oviposition by fresh vegetation. Larger nymphs may also be able to hibernate successfully and would become adults early in spring. This wide range of oviposition potentialities has no doubt led to the assumption of the existence of additional generations.

Migrations may thus be composed of entirely fresh males and females just becoming sexually mature, or they may be forced by drying vegetation and would then include both fresh adults and those that had already oviposited in the previous season.

MICHELBACHER (A. E.) & ESSIG (E. O.). **Report on Alfalfa Weevil Investigation in California.**—*J. econ. Ent.* **27** no. 5 pp. 960-966. Geneva, N.Y., October 1934.

Except on the west side of the San Joaquin Valley, where an advance of about 5½ miles has been made, the area infested by the alfalfa weevil [*Hypera variabilis*, Hbst.] has hardly changed in central California since the first discovery of the weevil there in 1932 [*R.A.E.*, A **20** 644]. An investigation has therefore been made to determine the limiting factors In the San Joaquin Valley itself, where the population has remained small, climatic factors are of great importance. The largest number of larvae taken there in 100 sweeps of the net in any one lucerne field was 1,198, the average maximum for all fields being 200 or less. Even where the density of the larvae was greatest, injury was slight and mainly confined to the edges of the field. Some damage of a serious nature occurred in two localities, in one of which the climate was cooler in summer and warmer in winter owing to proximity to the sea. This more moderate climate probably allows the brood to extend over a longer period of time, so that the larvae are present in considerable numbers throughout most of the year, particularly during the growing season. Adults probably reach sexual maturity at different times throughout the year, and the existence of a second brood is suggested by the occurrence in 1933 of two definite larval peaks, one at the end of March and one in July.

The slight nature of the injury caused by *H. variabilis* in Central California, in the lowland parts of which growing conditions are particularly favourable, is probably due to the rapid growth of the lucerne in the spring. In fields where over-frequent cutting has reduced its vigour, serious injury may result before the crop is ready for harvesting, but where the lucerne has been allowed to grow it is almost certain that it could be cut before damage becomes severe. The reduction in stand that occurs after four or more years of growth seems to be another factor favouring injury. The slower growth, combined with a thick, uniform stand, appears to produce a greater concentration of the weevils. In one locality where second-year lucerne was ready to cut at a time when the neighbouring older fields were one-half to

two-thirds grown, the difference in larval population was very marked. The degree of injury depends to a great extent on the time of cutting the first crop. Almost every case of serious injury could have been avoided by timely cutting. Where the preceding winter and spring have been dry, the damage is accentuated by the drying up of lucerne that is not cut immediately on maturing. Delayed harvesting allows time for many larvae to complete their development so that the large number of adults carried over to the next crop increases potential damage for the following year. Although the extent of dispersal has not been exactly determined, it appears that considerable movement takes place and that there is some migration from neglected to cultivated fields. Where some weeks are allowed to elapse between harvesting and irrigation, the crop fails to make rapid growth and becomes more susceptible. Early winter cultivation has been observed to stimulate growth and so reduce injury, but cultivation practised too late may have the opposite effect.

The investigation suggests that *H. variabilis* can be held in check without the use of insecticides. Numerous natural enemies, including birds, predacious insects and probably fungi, restrict its numbers, and an attempt will be made to introduce its parasites into the infested areas. *Bathyplectes curculionis*, Thoms., is the only parasite at present known to be established. Populations encountered on the first crop in 1934 were in general greater than that of 1933, probably because of the mild autumn and winter.

Compere (H.) & Flanders (S. E.). *Anarhopus sydneyensis* **Timb., an Encyrtid Parasite of** *Pseudococcus longispinus* **(Targ.) recently introduced into California from Australia.**—*J. econ. Ent.* **27** no. 5 pp. 966–973, 2 figs., 1 ref. Geneva, N.Y., October 1934.

When *Anarhopus sydneyensis*, Timb., was first brought to California from Australia in parasitised mealybugs in 1931 [*R.A.E.*, A **20** 38], the parasites on emerging were confined with *Pseudococcus gahani*, Green, *P. maritimus*, Ehrh., *P. citri*, Risso, and *Phenacoccus gossypii*, Tns. & Ckll. Although they were seen to oviposit, no reproduction was obtained. At this time *Pseudococcus adonidum*, L. (*longispinus*, Targ.) was not considered of economic importance in California, but in the summer of 1933 a serious infestation occurred on *Citrus* [**22** 100] and it was decided to arrange for shipments of parasitised examples of this mealybug from quince trees in New South Wales [*cf.* **21** 77]. From a first consignment of 100 parasitised mealybugs, received on 4th November 1933, most of the adults of *Anarhopus* had emerged and died, and only 5 females were obtained. One of these was allowed to oviposit in *Pseudococcus adonidum* from 5th to 7th November and then placed in cold storage subject to removal for honey-feeds at intervals of 3–4 days. The mealybugs in which it oviposited mummified on 18th November and 12 male parasites issued from them, beginning on 4th December. The female was then mated with her offspring. Of the second consignment, received 2nd December, 8 out of 16 mummified mealybugs were in good condition and yielded 6 females and 1 male of *Anarhopus*. The females were paired and released in cages containing *P. adonidum* on potato sprouts. Progeny of both sexes began to emerge on 1st January 1934, and field colonisation was begun on 6th March when adults were liberated on trees infested with *P. adonidum*.

The egg, the first and second instar larvae and the manner of oviposition of *A. sydneyensis* are described, and the original description of the adult is quoted. The females oviposit in mealybugs of all sizes, though attempts to introduce eggs into very small individuals are rarely successful. Medium to large sized hosts are usually selected, and a marked preference is shown for *P. adonidum*, though oviposition can be induced on any of the mealybugs mentioned above. Oviposition is rare in *P. gahani* unless it is smeared with the body fluids of *P. adonidum*. Only one larva was normally found in a host. When bred in the insectary at about 80°F., the Encyrtid took about a month to complete its life-cycle. Although abundantly supplied with host material, it did not reproduce freely in the insectary, the third generation producing 20 males to each female, although the two sexes were present in equal numbers when the females were ovipositing. In some cages there was no reproduction, and the numbers generally were far below expectation.

McGregor (E. A.). *Platynota stultana* **Wlsm. (Lepidoptera) damaging green Oranges in Southern California.**—*J. econ. Ent.* **27** no. 5 pp. 974–977, 3 figs., 2 refs. Geneva, N.Y., October 1934.

Injury to immature oranges by the Tortricid, *Platynota stultana*, Wlsm., was observed in southern California late in May 1933. The larvae almost always occurred between the sepals and base of the fruit, within loosely spun webbing. They gnawed the calyx and stem and particularly the rind near the base of the orange, and sometimes also fed on the sides or within the cavity of the navel end. The scars are deeper and more jagged than those caused by the citrus thrips [*Scirtothrips citri*, Moult.], which they otherwise resemble closely. When they ring the stem end of the fruit, they stunt its growth, probably by interrupting the flow of sap. It is estimated that 10 per cent. of the crop is lost in this way.

A survey showed that *P. stultana* is generally distributed throughout southern California, being found in 40 out of 42 orchards examined. In 1933, the percentage of fruits infested averaged 25·6, but only a relatively small percentage was sufficiently damaged to lower the grade. A Braconid parasite, *Apanteles aristoteliae*, Vier., was reared from the larvae. According to subsequent observations, recorded in a footnote, *P. stultana* occurred less commonly in 1934 than in 1933, but a count made in one orchard showed that about 96 per cent. of the green oranges had been injured during May. Promising results against the larvae were obtained in this district by the application of two sprays and one dust containing cryolite and by one spray and one dust containing barium fluosilicate. A dust containing one of these insecticides and sulphur might serve to control both *Platynota* and thrips. Observations made in the affected districts in 1934 showed that another Tortricid, *Eucosma* (*Argyrotaenia*) *citrana*, Hb., is responsible for damage to green oranges similar to and greater than that caused by *P. stultana*.

Woglum (R. S.) & LaFollette (J. R.). **The double Treatment for Scale Pests in California Citrus Orchards.**—*J. econ. Ent.* **27** no. 5 pp. 978–980, 4 refs. Geneva, N.Y., October 1934.

The development of the method against Coccids on *Citrus* in California of using a combination of an oil spray and fumigation with

hydrocyanic acid gas is briefly outlined, and the various factors influencing its employment are discussed. A heavy infestation of black scale [*Saissetia oleae*, Bern.] following a heat wave in 1917 that had almost eliminated it, coupled with unsatisfactory results from the fumigation alone hitherto employed for its control, led to the introduction of various proprietary sprays, and in 1923 the first highly refined lubricating oil was used [*cf. R.A.E.*, A **13** 629]. An analysis in 1924 of the results of combined spray and fumigation treatments tested in 1923 showed that fumigation followed by a spray of miscible oil and lime-sulphur was the most effective, generally resulting in a uniform kill throughout the tree. This combination was widely used for a few years, but was finally superseded by white-oil sprays.

Combination treatment in the control of the red scale [*Aonidiella aurantii*, Mask.] was first tried in 1924 [*cf.* **14** 493, 651], when lime-sulphur alone or in combination with miscible oil was followed by fumigation at intervals of from 2 to 10 days, without, however, giving results superior to those obtained by a single fumigation. In October–November 1925 an average mortality of 99 per cent. was obtained by the application of white oil followed by fumigation, and this method was quickly put into commercial use. It was found that oil sprays were more toxic to the scales on the fruit, and fumigation to those on the wood ; the dosage of each when used in combination must not be below that required for individual treatment. Crawlers hatching shortly after the spray has been applied are unable to settle on the oil coating. In 1926 and 1927 oil spraying in summer followed by fumigation in winter gave results comparable to the regular autumn combination, and this practice is the most common double treatment against *A. aurantii* at the present time.

Changes in the application of white-oil sprays to *Citrus* in California since their first introduction have been mainly influenced by the injurious effect of the oil on the trees. Lemons have proved to be more tolerant to high viscosity oils than oranges, certain varieties of which are more susceptible than others. Lighter oils should be used in the hot and dry interior valleys than in the cool coastal areas. Oils are applied to lemon trees when little pickable fruit is present, and to oranges when the new crop has reached the size of a walnut and after the old crop has been removed. Winter work is particularly avoided, and in the case of lemons the tendency is toward spring work to avoid weather influences. In many cases last season, soluble oils were used in place of oil emulsions and tank mixtures, and promise completely to displace them. Soluble oil spreads better than either paste emulsion or tank-mix sprays, and there is less penetration of the plant tissues.

WAKELAND (C.). **The Influence of forested Areas on Pea Field Populations of *Bruchus pisorum* L. (Coleoptera, Bruchidae).**—*J. econ. Ent.* **27** no. 5 pp. 981–986, 3 figs., 2 refs. Geneva, N.Y., October 1934.

During 1930–32, studies of *Bruchus pisorum*, L., were made in Northern Idaho and Eastern Washington to determine whether infestation varies with the situation of the fields in timbered or mountainous areas, which may afford hibernation quarters for the adults [*cf. R.A.E.*, A **22** 418]. Extensive field sweepings of growing peas were made with fine muslin nets, and 10,292 Bruchids were captured.

The variation in growth conditions was so great that general conclusions could only be obtained by treating the records as random observations. The pea-growing area near the base of Moscow mountain, one of the most heavily infested districts, was therefore divided into a number of radial zones, circumscribing successive circles one mile apart round a fixed point on the mountain. All data for each zone were averaged on the basis of the number of Bruchids taken in 100 sweeps of the net. Although infestations were apparently heavier near the base of the mountain, the decrease was not continuous in proportion to the distance away from it, since the timber afforded hibernation quarters. Records made in 1932 of adults hibernating under bark of *Pinus ponderosa* along ridges near which population records were high confirmed this suggested influence of forested areas. The adults are known to fly at least 3 miles from peafields to forest hibernation quarters.

When the district was divided into zones a mile wide, approximately parallel to the margins of the timbered area, a higher degree of correlation with the extent of field populations was immediately evident. It is therefore concluded that forested areas rather than high elevations favour populations of *B. pisorum*.

KNOWLTON (G. F.). **Lizards as a Factor in the Control of Range Insects.**—*J. econ. Ent.* **27** no. 5 pp. 998–1004, 2 refs. Geneva, N.Y., October 1934.

A study of the food habits of lizards inhabiting grazing land has been carried out in Utah during the past four seasons [*R.A.E.*, A **22** 88, 595, 727]. Most of the lizards that abound throughout Utah are entirely insectivorous. Data were secured by microscopic examination of the stomach contents of 5,446 individuals. A list of 13 species is given together with notes on the various orders or families of insects, etc., represented in their diet. A detailed analysis is given of the stomach contents of both adult and immature stages of 3,578 specimens of *Uta stansburiana*, which is the most abundant, widespread and beneficial range lizard in Utah, and of 1,352 specimens of *Sceloporus graciosus*, which consumes in addition to many other insects large numbers of Aphids and leafhoppers. It is concluded that when lizards are numerous in cattle grazing areas they should be classed with parasitic and predacious insects and birds as important biological control factors.

HOSKINS (W. M.) & CRAIG (R.). **The Olfactory Responses of Flies in a New Type of Insect Olfactometer. I. Theory and Design of the Olfactometer.**—*J. econ. Ent.* **27** no. 5 pp. 1029–1036, 2 figs., 4 refs. Geneva, N.Y., October 1934.

The disadvantages of two recently designed insect olfactometers [*R.A.E.*, A **18** 421; B **21** 187] are pointed out. In the authors' opinion an ideal olfactometer should satisfy the following requirements: close approach to normal environment; response of a large proportion of the insects tested; absence of factors affecting the results other than the chemical stimulus under consideration; quickly obtainable results on either a homogeneous or heterogeneous population. An apparatus believed to embody most of the desired qualities is described in detail. Results are recorded of preliminary tests of this apparatus in which

Lucilia sericata, Mg., was used as the experimental insect. It was observed that a given substance may be attractive at low concentrations and repellent at higher ones.

PARKER (W. B.). **Recent Developments of the Vapo Dust Method of Pest Control.**—*J. econ. Ent.* **27** no. 5 pp. 1036–1040. Geneva, N.Y., October 1934.

Descriptions are given of two types of apparatus designed for the application of Vapo Dust, a trade name for a concentrated liquid insecticide or fungicide, atomised, diluted and carried by air [*R.A.E.*, A **21** 473]. The first uses an amount of air under high pressure that is relatively small as compared with amount of oil, etc., that it carries, and produces a dense fog of very fine particles ; the other produces a light fog of larger particles and develops about 4,000 cu. ft. of air for each U.S gal. of oil. Examples are given of the large areas that can be covered with the latter machine. Experience has shown that a little wind is not unfavourable to the use of this method, which may be applied under any conditions suitable for spraying. Work continued by day and night has proved effective. A track-laying trailer pulled by a tractor, which can be operated regardless of soil conditions, was found the most satisfactory means of transport, travelling at 4–6 miles an hour in orchard work and up to 10 miles in vineyards. Two rows of vines, but only one row of trees, can be treated at a time.

Experimental work against leafhoppers showed that the addition of pyrethrum to oil is necessary to kill such insects as are only lightly hit. Rapid evaporation renders ordinary emulsions containing oil emulsified in water unsatisfactory as a base for Vapo Dust; but in water-in-oil emulsion (which by the Vapo-Dust process can be applied without injury to the plants), the water dilutes the oil and the oil prevents the water from evaporating and gives the material the wetting effect of oil rather than water. Water-in-oil emulsions containing as much as 75 per cent. water, while still avoiding the use of large quantities of water, make it possible to use more material to the acre and result in better coverage and less danger of oil drenching. Lime-sulphur, Bordeaux mixture, lead arsenate, nicotine, rotenone, pyrethrum, etc., may be incorporated in either the oil or the water phase. Preliminary experiments with these materials, alone and in combination, gave promising results.

Effective control of the brown apricot scale [*Lecanium corni*, Bch.] and the eggs of the red mite was obtained in California with a special phytonomic oil applied in winter at 10–16 U.S. gals. to the acre, according to the size of the trees. The uniformity of the bloom in the following spring indicated the completeness of the coverage. Pyrethrum and light phytonomic oil at the rate of 6–7 U.S. gals. per acre proved very effective against both adults and larvae of thrips on prunes and nectarines. Nicotine also proved effective against thrips, and lime-sulphur in oil gave good control of the pear-leaf blister-mite [*Eriophyes pyri*, Pgst.]. The campaign against the grape leafhopper [*Erythroneura comes*, Say] was successful, both against the over-wintering brood and the first brood nymphs, which appeared after the vines were in full leaf. The rate of application was $3\frac{1}{2}$–4 and 4–5 U.S. gals. per acre, respectively. Over 95 per cent. of the nymphs and adults on vine foliage were killed. A high percentage of the serpentine leaf miner [*Agromyza pusilla*, Mg.] on peas was destroyed by Vapo

Dust, but egg laying and subsequent development was so rapid that the plants were soon badly re-infested. Details of costs are given, and the advantages of Vapo Dust pointed out.

HERBERT (F. B.). **Airplane Vapor Spraying : A Progress Report.**—*J. econ. Ent.* **27** no. 5 pp. 1040–1042, 1 ref. Geneva, N.Y., October 1934.

In continued work in spraying fruit trees from aeroplanes [*cf. R.A.E.*, A **22** 91], several thousand acres in California have been effectively treated. Prunes and apricots were sprayed with soluble oils (10 U.S. gals. to the acre) against the brown apricot scale [*Lecanium corni*, Bch.] and oblique-banded leaf-roller [*Tortrix rosana*, L.]. A high rate of scale mortality was obtained in 95 per cent. of the orchards treated, whereas those untreated remained heavily infested. Stimulation from oil sprays produced larger crops of prunes. Poor results obtained in a few cases can be traced to insufficient dosage or excessive wind, or, in the case of individual trees, to obstructions preventing the spray from reaching them. The larger limbs of trees are not covered heavily enough to control moss or the Coccids that infest this part of the tree, against which a heavier dosage of oil and caustic soda should be applied by ground machines once every 3 or 4 years.

In spring treatment of apricots, almonds, peaches and nectarines against fungi and insects, the oil included lead arsenate for the control of the twig borer [*Anarsia lineatella*, Zell.], and satisfactory results were obtained. All peaches received 6 U.S. gals. per acre. Grapes were sprayed at the rate of 4 U.S. gals. per acre for the control of the grape leafhopper [*Erythroneura comes*, Say]. Although the lower surface of heavy foliage was not covered well enough to kill a high percentage of nymphs, the kill of adults in the spring before the foliage had become thick proved highly satisfactory. Where heavily foliaged vines were trellised, it was essential to fly parallel to the rows. Minor improvements in equipment developed during 1933–34 are briefly described. The greatest area yet treated in a day by one aeroplane was 440 acres, over which 2,650 U.S. gals. oil were distributed, 1,000 acres of peaches being treated in 2 days and 2 hours by the same aeroplane.

MOORE (W.). **Fumigation Experiments with the California Red Scale under Orchard Conditions.**—*J. econ. Ent.* **27** no. 5 pp. 1042–1055, 1 fig., 4 refs. Geneva, N.Y., October 1934.

The results of fumigation with hydrocyanic acid gas on *Aonidiella aurantii*, Mask., under controlled conditions in the laboratory were found to be influenced by temperature and relative humidity [*R.A.E.*, A **22** 99]. Field experiments were carried out during the past season in a number of lemon orchards in California where this scale is known to be difficult to kill [*cf. loc. cit.*]. The following is substantially the author's summary : Kills of 99 per cent. or above can sometimes be obtained with normal (100 per cent.) dosages of hydrocyanic acid in all areas where *A. aurantii* is classed as resistant. The difficulty in killing this scale in certain areas in California cannot be due to an acquired tolerance to HCN, since good and poor kills may be obtained in the same orchard on the same night. A series of fumigations carried out during the summer season indicates that when the hydrocyanic acid is applied by atomisation the kill diminishes as the temperature increases,

whereas in winter this relationship between kill and temperature is masked by other factors. Winter fumigations in which the hydrocyanic acid is applied with the atomiser show poorer kills when the relative humidity is below 50 per cent., but when it is applied with the diffuser (in which the liquid is volatilised by being passed through heated coils) the result is independent of relative humidity. Poor kills obtained during the winter with the atomiser are due to low soil temperatures causing faulty distribution of the gas in the tent. The average kill of a series of fumigations is higher and more uniform with the diffuser than with the atomiser. *A. aurantii* is most difficult to kill at the end of the second moult. In fumigations where results are poor, however, survivors occur in all stages of development.

Herms (W. B.) & Ellsworth (J. K.). **Field Tests of the Efficacy of coloured Light in trapping Insect Pests.**—*J. econ. Ent.* **27** no. 5 pp. 1055–1067, 5 figs. Geneva, N.Y., October 1934.

Tests in California with suction light traps, a brief account of which is given, indicated that gnats (*Chaoborus lacustris*, Freeborn) probably have no selective colour response, and that the rate of their attraction to lights depends on the intensity and not on the wave length of the latter.

A summary is given of the results of tests in an apple orchard in 1929 with *Cydia pomonella*, L., which suggested that insects that are attracted to low intensities of light, or are at least not light-bound under low intensities, may be kept out of a given habitat by high intensities [*R.A.E.*, A **21** 163]. In laboratory tests, insects have shown a high degree of colour selection. As all the colours of the visible spectrum are found in white light, all positively phototropic insects will be more or less attracted to it. If various species respond to particular colours, a high degree of relative selectivity should be obtained with monochromatic light. Laboratory tests appeared to indicate that light blue is the colour particularly attractive to *C. pomonella*. To compare the effectiveness of coloured lights against this moth in an orchard, traps fitted with red, blue and white lights were used in California in 1933. The period of illumination lasted from 12th May to 16th October, with the lights working from 5 p.m. to 5 a.m. Unsprayed trees influenced by the blue light showed 50·3 per cent. infested apples, and those in a control plot 73·6 per cent. The corresponding percentages for sprayed trees were 34·5 and 40·1. Unsprayed apples under the red and white lights showed 77·3 and 74·2 per cent. infestation respectively. The numbers of moths and (in brackets) females caught were 2,930 (1,299) in 378 trap-days by blue light, 132 (34) in 101 trap-days by white and 271 (91) in 41 trap-days by red.

In laboratory experiments, *Ephestia figulilella*, Gregson, showed a colour preference slightly different from that of *C. pomonella*. In four nights' trapping in a fig drying-yard with two light traps from 11th to 15th October 1933 a darker blue light trapped 1,578 adults (51·9 per cent. females) and the paler light 739 (53·4 per cent.). Extensive tests in dried fruit warehouses gave excellent results, an average catch of 1,000 moths (*Ephestia* and *Plodia*) for each of a number of nights in one warehouse effectively clearing it of these pests. A satisfactory reduction of infestation by *Platyptilia carduidactyla*, Riley (artichoke plume moth) was secured in tests carried out with red, midnight blue and white lights, the blue lights apparently being the most effective.

A progress report is also given on tests carried out for the control of *Erythroneura comes*, Say, on vines with red, midnight blue and white lights. The midnight blue lights attracted 88 per cent. females and the red only 7 per cent. The white light traps attracted 38 per cent. females or about the normal field ratio.

Donohoe (H. C.) & Barnes (D. F.). **Notes on Field Trapping of Lepidoptera attacking dried Fruits.**—*J. econ. Ent.* **27** no. 5 pp. 1067–1072. Geneva, N.Y., October 1934.

The following is based the author's summary: A mixture of $\frac{1}{4}$ pint malt syrup and 2 quarts water with the addition of yeast, renewed twice weekly, has proved effective as a trap material for experimental trapping of *Ephestia figulilella*, Gregson, and other Lepidopterous pests of stored products in vineyards and orchards in California. The operation of such traps in a variety of situations over three seasons has shown the presence in the field of several species [*R.A.E.*, A **23** 18] usually thought to be pests of stored products only. Parasites of *E. figulilella* taken in the baits included *Microbracon hebetor*, Say, *Nemeritis canescens*, Grav., and *Mesostenus gracilis*, Cress. The first two, at least, also parasitise *Plodia interpunctella*, Hb.

Donohoe (H. C.), Barnes (D. F.), Fisher (C. K.) & Simons (P.). **Experiments in the Exclusion of *Ephestia figulilella* Gregson from drying Fruit.**—*J. econ. Ent.* **27** no. 5 pp. 1072–1075. Geneva, N.Y., October 1934.

Notes are given on preliminary tests in California, some of which have already been noticed [*R.A.E.*, A **23** 19], on the use of tobacco shade cloth to exclude *Ephestia figulilella*, Gregson, from drying fruits. Trays in which fruit was drying were placed under cloth stretched over a frame of 18 inch stakes connected by wires. After the trays were stacked, and while the fruit was boxed, each stack of trays or boxes was covered with a piece of cloth.

In experiments in 1932 with figs picked between 15th August and 5th September, when the temperature during each drying interval had exceeded 95°F., there was little difference in infestation between fruit dried in exposed and covered trays; the surface temperature had been sufficiently high to destroy part of the original infestation. In figs picked between 8th and 26th September and dried at daily air temperatures the maximum of which only once exceeded 94°F., infestation amounted to 3·1 per cent. in protected and to 38·2 per cent. in exposed fruit. In similar tests in 1933, only about half as many were infested in covered as in exposed lots.

During 1933, continuously protected apricots and apricots protected from the time of stacking showed no infestation, those protected only in the boxes 5·7 per cent., and unprotected samples 57·4. The corresponding figures for nectarines were 7·7, 11·0, 80·7 and 100 per cent., and for peaches 2·0, 3·5, 71·2 and 97·1 per cent. The very slight difference in infestation between fruit covered continuously and that covered only at stacking shows that little is gained by covering split fruit while it is spread on trays to dry.

Donohoe (H. C.) & Barnes (D. F.). **Notes on Host Materials of *Ephestia figulilella* Gregson.**—*J. econ. Ent.* **27** no. 5 pp. 1075–1077. Geneva, N.Y., October 1934.

An account is given of observations by which the sequence of fruits [*R.A.E.*, A **23** 19] attacked by *Ephestia figulilella*, Gregson, in the field in California was ascertained. In the laboratory full-grown larvae have been obtained from a closed paper bag containing a quantity of insects, including *E. figulilella*, killed by a light trap several weeks earlier. Since the females of this species have been observed to eject eggs following electrocution by this trap, it is evident that the larvae mentioned developed by feeding on dead animal matter In the laboratory larvae fed readily on walnut meats.

Quayle (H. J.) & Rohrbaugh (P. W.). **Temperature and Humidity in Relation to HCN Fumigation for the Red Scale.**—*J. econ. Ent.* **27** no. 5 pp. 1083–1095, 5 figs. Geneva, N.Y., October 1934.

In an attempt to evaluate the importance of temperature and humidity in the fumigation of *Citrus* in California with hydrocyanic acid gas, tests were made in the laboratory on *Aonidiella aurantii*, Mask., on lemon fruits, and (to ascertain the effect of the same factors on the plant) on rooted lemon cuttings in pots. The infested lemons were fumigated at atmospheric pressure in 100 cu. ft. capacity vacuum fumigators, fitted with complete air-conditioning equipment, usually with 2 cc. liquid HCN for 45 minutes. For the lemon cuttings 30–60 cc. were used.

The following is largely taken from the authors' summary : Temperatures between 50 and 90°F. during fumigation only made no significant difference to the kill. Temperatures to which the scales were subjected previous to fumigation had a marked effect on the fumigation results ; regardless of temperature during fumigation, there was a higher mortality among scales conditioned at 50 and 75°F. than among those conditioned at 90°. With active insects, on the other hand, a higher temperature before or during HCN fumigation is generally believed to result in a higher percentage of kill. In experiments where the relative humidity was 50–59 and 80–89 per cent. respectively, there was no significant difference in the percentages of scale killed, but at 90–100 per cent. relative humidity, the mortality was less than at 22–52 per cent. It is generally considered, however, that in field work an increase in kill is caused by the tightening of the tent in case of high humidity ; and gas concentration studies under wet and dry tents indicated a greater concentration under a wet tent, though the decrease in concentration was roughly equal in each case, probably owing to the absorption of gas by the wet tent and to the escape of gas through the dry tent.

In general, the experiments on plants gave results contrary to practical experience in the field. In practical fumigation of *Citrus* the injury to plants is greater at high than at low temperatures ; winter fumigation in California causes less injury than summer fumigation, although winter dosages are usually higher. In these tests (at a relative humidity of 70 per cent.), however, the plants were more severely damaged when they were kept before and during fumigation at 50°F. than at 90°F. It is generally recognised that it is better to fumigate on soils that are rather too dry than too wet, but in the limited

experiments in these studies, a greater number of rooted lemon cuttings were injured when the soil was allowed to become very dry without the plants wilting than when the soil was very wet. Discrepancies in the reaction of the plants to humidity in the experiments may be due to the tightening of the tent at high humidities in the field. The possibility that the dormancy of the trees, the variation in reducing sugars at different seasons, or some water relation between the trees and the soil are factors of greater importance in resistance to HCN than temperature at the time of fumigation may explain the contradictions between the results of this study and general experience.

HERRICK (G. W.). **A critical Examination of two Papers on Moth Repellents.**—*J. econ. Ent.* **27** no. 5 pp. 1095–1099, 3 figs. Geneva, N.Y., October 1934.

The author examines in detail the experiments described in two recent papers [*R.A.E.*, A **17** 556; **22** 405] that claim to prove that paradichlorobenzene, naphthalene and cedar oils are inefficient as repellents against adults and larvae of *Tineola biselliella*, Humm. He considers that the first set of experiments actually proves that paradichlorobenzene and naphthalene are repellent to the larvae of clothes moths, since every larva moved away from the fumigants. Further, the number of larvae used, and the small amount, weak concentration and wide dispersion of the materials makes the results obtained unreliable. He considers that the data obtained in the second experiment are wholly inadequate to prove the thesis of the author, and that there is again evidence that the materials used were in fact repellent. He insists that a different technique must be devised in order to obtain reliable results in such tests.

QUAYLE (H. J.). **Another Species of Thrips on Citrus Fruits.**—*J. econ. Ent.* **27** no. 5 p. 1100. Geneva, N.Y., October 1934.

Frankliniella gossypii, Morg., was observed in great numbers on various species of *Citrus*, but chiefly on navel oranges, in the Hemet valley, California, on 23rd January 1934. The feeding on the fruit resulted in markings of an irregular form and size and of a lighter yellow colour than the deep tinge of the mature oranges. The presence of young larvae indicated that eggs had been laid somewhere on the trees. Examination in the middle of February showed a great general reduction in numbers, but a larger proportion of mature larvae. The nearest important plantations of cotton, the only plant from which *F. gossypii* has previously been recorded, are 40–50 miles away beyond an extensive mountain range, but cotton waste has been used to a limited extent in the Hemet valley.

MARLOWE (R. H.). **An artificial Food Medium for the Mediterranean Fruit Fly** (*Ceratitis capitata* **Wied.**)—*J. econ. Ent.* **27** no. 5 p. 1100. Geneva, N.Y., October 1934.

A non-fermenting mixture composed of 2 cc. extracted honey, 4 cc. crushed papaya, 3 cc. water, 1 gm. brown sugar and ·16 gm. agar-agar, which after preparation should be autoclaved at 15 lb. pressure for 20 minutes, has been successfully used as a food for *Ceratitis capitata*, Wied. Although as attractive as natural fruits, it will last for

months. Female flies oviposited in it freely, though it was found necessary to reduce the amount of agar-agar to ·1 gm. in order to allow free movement of the newly hatched larvae, over 300 of which were successfully reared. This method may be standardised for the rearing of fruit-fly larvae. The juice of other fruits could doubtless be substituted for papaya juice.

Burks (B. D.). **Food Plant Studies of the Chinch Bug.**—*J. econ. Ent.* **27** no. 5 pp. 1100–1101, 1 ref. Geneva, N.Y., October 1934.

In rearing experiments with chinch bugs [*Blissus leucopterus*, Say] carried out in Illinois in 1934, the insects were hatched in pill boxes from eggs collected in the field and were colonised on plants growing in a nutrient solution [*R.A.E.*, A **10** 3] in 100 cc. test tubes. A mean temperature of 86·7°F. was maintained in the insectary, and the relative humidity in the tubes was between 80 and 90 per cent. Electric light supplied 1,000 foot-candles of illumination (0·1 of standard solar illumination) by day and night, almost all sunlight being excluded. Lists are given of the numerous grasses on which *B. leucopterus* was successfully reared and of other plants (chiefly leguminous) on which it failed to develop. The median times taken to develop on each varied from 33–37 days. None of the plants died during the tests, but 17 per cent. of the bugs reared on grasses failed to develop.

Swingle (M. C.). **Difference in Action of Derris and Pyrethrum against the Imported Cabbage Worm shown by Experiments with Gelatin Films containing these Plant Materials.**—*J. econ. Ent.* **27** no. 5 pp. 1101–1102. Geneva, N.Y., October 1934.

A piece of tinned sheet metal was dipped in a 10 per cent. aqueous solution of edible gelatine containing 0·7 per cent. high grade derris or pyrethrum powder in suspension, drained and allowed to dry at room temperature. The gelatine adhering to the plate was stripped off in the form of a transparent paper-like film, from which disks $\frac{7}{8}$ in. in diameter were cut and pressed between two moistened cabbage leaf disks of the same size. Feeding tests were then made with full-grown larvae of *Pieris* (*Ascia*) *rapae*, L., which had previously eaten similar sandwiches made with gelatine alone without being in any way affected. One larva and one sandwich were placed in each of several petri dishes, the sandwich being made so that no external surface of the larva except the mouthparts could come into contact with the particles of derris or pyrethrum. The larvae ate very small portions of the derris film and usually died within 24 hours, but were not killed by the pyrethrum film, upon which they fed until the sandwiches were consumed. Additional experiments, made by the ordinary sandwich method in case the gelatine had prevented the pyrethrum from exerting its toxic effect, gave similar results.

When the larvae were allowed to crawl in petri dishes over which films had been poured and allowed to dry, untreated leaves being supplied after 6 hours, those that had come into contact with the pyrethrum-gelatine films died within 24 hours, but those on derris-gelatine were not affected within 24 hours and most of them were normal at the end of two days.

Hough (W. S.). **Nicotine kills Codling Moths.**—*J. econ. Ent.* **27** no. 5 pp. 1102–1103. Geneva, N.Y., October 1934.

Numbers of codling moths [*Cydia pomonella*, L.] were observed in Virginia late in May flying from apple trees during the application of nicotine sprays, many apparently being killed. On 8th June a sheet was placed beneath the west half of an apple tree adjoining a packing shed from which moths were known to be emerging in numbers, during the application of a spray consisting of 2 lb. copper sulphate, 5 lb. Black-Leaf-155, 6 lb. hydrated lime and 3 U.S. quarts Orthol-K emulsion to 100 U.S. gals. water. The temperature was 65°F., and there was a slight breeze from the south. Of 77 moths taken from this sheet only 6 revived and escaped. Moths that lived for a day or two before succumbing appeared to have suffered paralysis of the wings and were unable to fly. At a repetition of this test on 20th June when moth flight was greatly reduced, only 4 of the 27 moths that fell revived. After a further application of a double dosage of nicotine 3 hrs. 20 minutes after the first, no moths fell or were seen leaving the tree, indicating that the first spray had cleared it.

Only volatile or free nicotine appeared to kill the moths. Fixed nicotine (nicotine bentonite or nicotine sulphate with oil) was not effective. Nicotine was liberated by the addition of lime to the spray containing fixed nicotine. It was discovered that the same effect could be obtained when the quantity of lime did not exceed 3 lb. to 100 U.S. gals. with 5 lb. nicotine bentonite (8 per cent. nicotine). The data indicate the possibility of killing 85 to 90 per cent. of the moth population in the trees at the time of spraying.

Brannon (L. W.). **A Note on Barium Fluosilicate Injury to Dahlia Flowers and the Results of a Test to determine the Toxicity of this Material to Blister Beetles.**—*J. econ. Ent.* **27** no. 5 p. 1103. Geneva, N.Y., October 1934.

A severe infestation of *Epicauta cinerea*, Forst. (*marginata*, F.) causing considerable damage to a small commercial patch of dahlias was observed in August 1933 in Virginia. Attempts to control the beetles by hand picking failed. A light application with a hand duster of a mixture consisting of equal parts of 80 per cent. barium fluosilicate and wheat flour, made at 4 p.m. on 9th August at 85°F. and 73 per cent. relative humidity, caused severe scorching of the flowers by 14th August. A total of 50 beetles collected from the plants soon after dusting and placed in the insectary without food were all dead after 2 days, none of the controls having died in this time, but only a few dead beetles were found beneath the plants 5 days after treatment. As very few beetles were found on either the treated or untreated plants, it was thought that the others either crawled away to die or were repelled by the dust.

Baker (W. W.). **Notes on the Occurrence of the European Weevil, *Tychius* (*Miccotrogus*) *picirostris* Fab., in western Washington.**—*J. econ. Ent.* **27** no. 5 pp. 1103–1104, 2 refs. Geneva, N.Y., October 1934.

Three weevils collected from clover in Washington State in 1929 and 1931 were identified by L. L. Buchanan as *Tychius* (*Miccotrogus*) *picirostris*, F. He believed this to be the first authentic record of this species in North America, the weevils previously identified as *T.*

picirostris in the eastern United States being probably *T. griseus*, Schaeffer. *T. picirostris* has since been taken frequently from clovers and grasses in western Washington, being found in every month except December. White, alsike and red clovers appear to be the preferred food-plants in the order named. Individual adults were observed feeding in the blossoms of a native strawberry and on the drupelets of ripe blackberries ; it is thought that they might do considerable damage to blackberries near heavily infested clovers.

McKenzie (H. L.). **The Green Fruit or Peach Beetle, *Cotinis texana* Casey, in California.**—*J. econ. Ent.* **27** no. 5 p. 1110. Geneva, N.Y., October 1934.

In September 1934, *Cotinis texana*, Csy., was found for the first time in California, on figs and grapes in Riverside. It has a preference for ripe peaches and also feeds freely on a variety of other fruits. It is possible that the larvae were brought into California from Arizona or New Mexico in manure, in which the beetle is known to breed. The adult is very briefly described.

da Costa Lima (A.). **Moscas de frutas do genero *Anastrepha* Schiner, 1868.** [Fruit-flies of the Genus *Anastrepha*.]—*Mem. Inst. Osw. Cruz.* **28** no. 4 pp. 487–575, 54 figs., 3 tables, 15 pls., 107 refs. Rio de Janeiro, 1934. **Nota adicional ao artigo sobre as especies do genero *Anastrepha*.** [An Additional Note to the Paper on the Species of the Genus *Anastrepha*.]—*T.c.* pp. 603–604.

The first paper comprises notes on the species of *Anastrepha* hitherto known and on 16 new ones, with a key. Indices to the species and to the plants infested are included.

In the second, the author discusses some divergences between his views and those of Greene [*R.A.E.*, A **22** 538]. He does not consider *A. fraterculus* var. *mombinpraeoptans*, Seín, and *A. unipuncta* Seín [**22** 151] to be synonymous, respectively, with *A. acidusa*, Wlk., and *A. suspensa*, Lw., *A. unipuncta* being the species recorded by North American authors as *A. acidusa*? from Cuba and *A. suspensa* from Porto Rico. He himself records *A. acidusa* as occurring in Jamaica only, the true *A. fraterculus*, Wied., in Mexico, Central America, the Antilles, Colombia, Peru, Brazil, Paraguay and Argentina, and *A. fraterculus* var. *mombinpraeoptans* in Porto Rico. North American workers have misidentified *mombinpraeoptans* as *acidusa*, and it is the fly figured by Howard in 1898 as *A. acidusa* from peach in Mexico.

A. soluta, Bezzi [**7** 269], which occurs in Brazil, is also considered a variety of *A. fraterculus*.

Veitch (R.). **Rice Weevil in Maize.**—*Qd agric. J.* **42** pt. 3 pp. 328–331. Brisbane, 1st September 1934. Also as *Adv. Leafl. Dep. Agric. Qd*, no. 13, 4 pp., 2 figs.

An account is given of the bionomics and control of *Calandra* (*Sitophilus*) *oryzae*, L. [*cf. R.A.E.*, A **16** 224], which causes severe loss of stored cereals and cereal products in Queensland, and also breeds on maize in the field. The females may deposit as many as 400 eggs, which are laid singly in small cavities made on the surface of the grains. Most of the eggs hatch, and a small initial infestation may assume serious dimensions, particularly during warm weather. The grain may be

reduced almost to powder in severe infestations by the larvae, and damaged to a less extent by the adults, especially when it is subjected to long storage. Varieties of maize with long, tightly fitting husks should be grown. Maize crops exposed to attack should be harvested quickly, and all waste material should be destroyed. Stored maize should be fumigated for 36 hours at not less than 70°F. in air-tight containers with carbon bisulphide (4 or 5 lb. to 1,000 cu. ft. of space) [*cf.* **16** 225]. In severe infestations, a second fumigation may be necessary after two or three weeks. *Calandra* will be killed if infested maize can be kept at 140°F. for several hours. The weevil is very susceptible to the moisture content of grain, and the low moisture content of wheat in good condition when harvested prevents breeding in it.

Oishi (T.). *Emphytus albicinctus* **Mats. var.** *meridionalis* **Takeuchi.** [*In Japanese.*]—*J. Pl. Prot.* **21** no. 8 pp. 602–606. Tokyo, August 1934.

All stages are briefly described of the Tenthredinid, *Emphytus albicinctus*, Mats. var. *meridionalis*, Takeuchi, which is very injurious to strawberry in the Fukushima Prefecture and also occurs in the south of Honshu and Kyushu. Roses are also attacked. Hibernation takes place in the soil in the larval stage, and there are three generations a year, the adults emerging in late April and early May, in July and in September. The adults live for a week or less, and the females lay not more than 80 eggs in small masses on the leaves of the food-plant. The egg stage lasts 5–12 days and the larval 25–44. The larvae can be killed by a derris spray.

Noguchi (T.). **Supplementary new Insect Pests of** *Citrus*. [*In Japanese.*]—*J. Pl. Prot.* **21** no. 10 pp. 741–743. Tokyo, November 1934.

Brief notes are given on further insects [*cf. R.A.E.*, A **21** 147, 549] observed on *Citrus* in the Shizuoka Prefecture. These include the Geometrid, *Eupithecia carearia*, Leech; the Noctuid, *Parastichtis funerea* Heinr.; the Lamiids, *Exocentrus lineatus*, Bates, *Pterolophia* (*E.*) *leiopodinus*, Bates, *Mesosa japonica*, Bates, and *Monochamus subfasciatus*, Bates, all attacking the weakened or decaying branches and stems; and the Elaterid, *Corymbites notabilis*, Cand., and the Nitidulid, *Epuraea* sp., both of which attack the flowers and injure the fruit.

Okada (I.). *Fungivora centralis* **Mats., feeding on edible Fungi.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **6** no. 4 pp. 208–212, 2 figs. Tokyo, October 1934.

The adult is described of *Fungivora centralis*, Mats., a Mycetophilid that feeds on mushrooms and other fungi in Hokkaido. The adults live for about a week and are most common in October, but are also found in decayed stumps of trees from April to June. There appear to be 2 generations a year, and the larvae mature in 7–10 days in October.

Takano (S.). **Insects attacking** *Aeginetia indica* **Roxb.** [*In Japanese.*] —*J. Formosan Sugar Pl. Ass.* **12** no. 5–6 p. 150. Taichu, Formosa, 1934.

Aeginetia indica, a parasitic plant injurious to sugar-cane in eastern Formosa, is attacked by the Pyralid, *Daulia afralis*, Wlk., the

Pterophorid, *Platyptilia* sp., the Arctiids, *Pericallia* sp., and *Amsacta lactinea*, Cram., and the Trypetid, *Euphranta apicalis*, Hendel, the last being most effective in reducing its abundance.

SHIBUYA (T.). **The Castor-oil Plant in Formosa.** [*In Japanese.*]—*Bull. Govt Res. Inst. Formosa* no. 100, 93 pp. Taihoku, Formosa, August 1934.

At the present time 17 insects, most of which are moths, are known to attack castor [*Ricinus communis*] in Formosa. The more important are *Prodenia litura*, F., *Notolophus posticus*, Wlk., *Porthesia taiwana*, Shiraki, and *Clania formosicola*, Strand.

YANAGIHARA (M.). **Results of Studies on** *Sesamia inferens* **Walk., a serious Pest of Sugar-cane in Taichu Prefecture, Formosa.** [*In Japanese.*]—*J. Formosan Sugar Pl. Ass.* **12** nos. 1–3, reprint 53 pp., 4 col. pls. Taichu, Formosa, 1934.

The Noctuid, *Sesamia inferens*, Wlk., which is also widely distributed in the Loochoo Islands and Japan, is injurious to sugar-cane in Formosa in areas where rice is cultivated. All stages are described. Rice is preferred, both for oviposition and feeding, but the larvae attack a variety of graminaceous plants, including maize and Italian millet [*Setaria italica*], and migrate to sugar-cane when the rice is harvested. There are usually 5 generations a year in central and southern Formosa, the moths being abundant in June–July and November–March. They are active at night and live for up to 14 days, ovipositing for about a week. The female lays over 300 eggs in about 5 masses along the margin of the inner surface of the leaves, and the eggs hatch in 4–9 days in summer and 9–25 in winter. The larvae bore into the stalks and usually migrate in the second or third instars. They mature in 3 or 4 weeks, moulting 5–7 times, and the pupal stage, among the leaves, lasts 5–12 days in summer and 12–36 in winter.

Natural enemies include the Scelionid, *Telenomus* sp., parasitising the eggs; the Braconids, *Shirakia schoenobii*, Vier., and *Apanteles flavipes*, Cam., the Ichneumonids, *Angitia* (*Dioctes*) *lineata*, Ishida, and *Amauromorpha schoenobii*, Vier., and a fungus, *Cordyceps* sp., attacking the larvae; *Xanthopimpla stemmator*, Thnbg., another Ichneumonid and a Chalcidoid, parasitising the pupae; and the Elaterid, *Heterodères albicans*, Cand., the Carabids, *Scarites terricola*, Bonn., and *Chlaenius* spp., the earwigs, *Anisolabis annulipes*, Lucas, and *Proreus simulans*, Stål, and the ants, *Tetramorium guineense*, F., and *Pheidole* spp., which are predacious, the ants being utilised against the larvae in the field. Measures for control should be taken in the rice-fields rather than on sugar-cane.

KAWANO (T.). **Studies on the Life-history of** *Epilachna admirabilis*, **Crotch.** [*In Japanese.*]—*Kontyû* **8** no. 3 pp. 138–152, 1 pl. Tokyo, 1934.

Descriptions are given of all stages of the Coccinellid, *Epilachna admirabilis*, Crotch, which feeds on various cucurbits, including *Trichosanthes cucumeroides*, *Momordica charantia*, *Luffa cylindrica*, etc., and also, in both adult and larval stages, on *Solanum lyratum*. The adults sometimes devour the eggs of their own species, even when

food-plants are available. Near Tokyo there is one generation a year ; the full-grown larvae overwinter among fallen leaves and pupate in April, the adults emerging in about 3 weeks. The female lays 156–312 eggs in the course of about a month. Oviposition does not begin till August, and the beetles die in autumn. The larvae hatch in a fortnight, moult 4 times and become dormant about mid-October. The larvae of the second and third instars cannot survive starvation for more than about 10 days, but those of the fourth instar pupate and reach the adult stage when starved after 3 days' feeding.

Shibata (K.). **On the Effect of Naphthalene upon the Behaviour of Termites.** [*In Japanese.*]—*Trans. nat. Hist. Soc. Formosa* **24** no. 135 pp. 250–255. Taihoku, Formosa, 1934.

Experiments were conducted with soldiers and workers of *Termes* (*Odontotermes*) *formosanus*, Shiraki (which is very injurious to growing plants in Formosa), using an improved dark box originally designed by Richmond for studying phototropism [*R.A.E.*, A **15** 444]. Crude naphthalene proved to be repellent to the termites, 60 gm. mixed with 6,250 cc. soil preventing them from approaching within 10 ins.

Yamauchi (T.). **Studies on a Mermithid Worm parasitic in** *Margaronia pyloalis* **Wlk.** [*In Japanese.*]—*Bull. seric. Exp. Sta. Japan* **8** no. 8 pp. 383–424, 1 pl. Tokyo, 1934. (With a Summary in English.)

In Japan, *Hexamermis microamphidis*, Steiner, is parasitic in the larvae of *Margaronia pyloalis*, Wlk., which is very injurious to mulberry, and is found in them from May to November, being most abundant in early autumn. From 1 to 78 larvae of this Mermithid infest a single host, the percentage parasitised varying from 2·13 to 82. Larvae of *Bombyx mori*, L., *Arctornis chrysorrhoea* var. *xanthocampa*, Dyar, and other moths are also attacked. The caterpillars die when the parasites leave them to enter the soil. Oviposition chiefly occurs in summer, but continues for 2 years, the eggs hatching in 2 months in spring. The young larvae probably reach the host by creeping up the trees on rainy days or at nights, and entering it through the skin. The life-cycle is thought to occupy more than 4 years.

Takagi (G.). **On the artificial Breeding of Chinese Galls.** [*In Japanese.*]—*Insect World* **38** nos. 10–11 pp. 358–362, 395–399, 5 figs. Gifu, Japan, October–November 1934.

Takagi (G.). **On the Life-history of the Chinese Gall Aphid and the Formation of Galls by Inoculation.** [*In Japanese.*]—*Dobuts. Zasshi* **46** no. 11 pp. 473–481, 2 pls. Tokyo, November 1934.

In further studies [*cf. R.A.E.*, A **22** 240] of the life-history of *Melaphis chinensis*, Bell, in Korea, it was observed that the winged females that leave the galls on *Rhus* (which may contain as many as eight thousand Aphids) and migrate to the moss, *Mnium vesicatum*, in autumn, produce 9–37 young, which feed on the tender stalks and roots during the winter. Winged females emerge in late April and return to *Rhus*, producing apterous sexual forms on the stems. In late May, the sexual females produce single offspring, and each of these begins to form a gall on a leaf. In nature galls are not produced on young

trees of *Rhus* less than 40 ins. high, or on trees growing in places where there is no moss, but when these trees are artificially infested, galls may be produced on them.

Results of Plant Inspection. [*In Japanese.*]—No. 4 pp. 1–122, 4 pls. Nagasaki, Japan, Nagasaki Customs, Sect. Pl. Quar., April 1934.

Brief notes are given on insects intercepted in Japan on imported plants, and on insects likely to be introduced.

Woo (F. C.) & Cheng (T. S.). **A General Investigation of the Locust (*Locusta migratoria* L.) Outbreaks in China during the year 1933.** [*In Chinese.*]—*Spec. Publ. nat. agric. Res. Bur.* no. 5, 42 pp., 6 figs. Nanking, China, Minist. Industr. 1934. (With a Summary in English.)

In 1933 an outbreak of *Locusta migratoria*, L., occurred in a number of provinces of north-eastern China. The locusts of the first generation were present from mid-April to the end of August and those of the second from mid-June to mid-October. Particulars are given of the sites on which eggs were laid by the second generation and of the area infested, as well as of the general distribution of the locusts throughout the country, and maps illustrate the direction of migrations. The crops attacked were cereals, reeds, bamboo, cotton, sugar-cane and soy beans, and the loss sustained was estimated at nearly 15 million Mexican dollars.

[Talitzkiĭ (V. I.) & Nemlienko (F. E.).] **Талицкий (В. И.) и Немлиенко (Ф. Е.). The chief Pests and Diseases of Maize and their Control.** [*In Russian.*]—Med. 8vo, 95 pp., 73 figs., 3 refs. Leningrad, Izd. Inst. Zashch. Rast. [Publ. Inst. Plant Prot.] 1934. Price 3 *rub.*

This popular handbook is divided into three parts. The first, by Talitzkiĭ (pp. 5–59), comprises notes on the bionomics and control of the chief insect pests of maize in the Russian Union, and includes keys for their identification based on morphological characters and the type of injury caused ; the second, by F. E. Nemlienko (pp. 60–80), deals with diseases ; and the third, by both authors together (pp. 81–93), is devoted to a general review of agricultural and chemical control measures.

[Sakharov (N. L.).] **Сахаров (Н. Л.). Pests of Mustard.** [*In Russian.*] —Demy 8vo, 120 pp., 38 figs., 3 pp. refs. Saratov, Inst. Grain Fmg, 1934. (With a Summary in German.)

Notes, largely based on the literature, are given on the bionomics of a large number of insects that infest mustard in the Lower Volga Region [*cf. R.A.E.*, A **17** 584 ; **19** 443], the more important species being dealt with in some detail. In many instances all stages are described. Of the pests infesting stored mustard seeds, the mite, *Tyroglyphus farinae*, DeG., is the most important ; the infested seeds become damp, and they and the oil from them are rancid.

A section of 17 pages is devoted to measures for control. Calcium arsenate dust was found to be the best insecticide against all chewing insects [*cf.* **17** 585], and in 1931 an aeroplane was successfully used for

applying it. Sowing late in autumn renders the plants resistant to flea-beetles in spring and to the weevil, *Lixus ascanii* var. *albomarginatus*, Boh., in summer. Granaries that have been infested with *T. farinae* should be fumigated before fresh seed is stored in them. For this purpose, 8–10 oz. chloropicrin or 2–3 oz. carbon bisulphide should be used for each 100 cu. ft. space. Another effective measure is to wash the walls with kerosene mixed with lime-wash. Infested seed should be fumigated with carbon bisulphide at the rate of 20 oz. to 100 cu. ft. space if the stored seed is 6 ft. deep, or 17 oz. if it is 3 ft. deep or less.

[Gusev (V. I.) & Rimskiĭ-Korsakov (M. N.).] **Гусев (В. И.) и Римский-Корсаков (М. Н.). Key to the Injuries caused to Forest and ornamental Trees and Shrubs in the European Part of the U.S.S.R.** [*In Russian.*]—Demy 8vo, 429 pp., 297 figs., 11 refs. Leningrad, Goslestekhizdat [St. Forestry Tech. Publ.] 1934. Price 8 *rub.*

Keys are given to the Arthropods that attack a number of different trees and shrubs in European Russia, based on the type of injury caused and, where this alone is not sufficient, on the characters of the injurious stages of the pests. Indices are appended to the Russian and Latin names of the plants and pests.

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This handbook is intended to facilitate the identification of the chief pests and diseases of tobacco in Poland and neighbouring countries. The insects, etc., are arranged according to the type of injury they cause, and brief notes on their appearance and control are included. Indices are appended to the Polish, Latin, French and English names of the diseases and pests.

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